SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30

1. REQUISITION NUMBER	PAGE 1 OF
PR-CI-03-10585	

2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE	4. ORDER NUMBER	5. SOLICITATION NUMBER	6.SOLICITATION ISSUE DATE
			PR-CI-03-10585	

7. FOR SOLICITATION INFORMATION CALL:	a. NAME	b. TELEPHONE NUMBER *(No collect calls)*	8. OFFER DUE DATE/ LOCAL TIME
	DAVID H. PLAGGE	**(513)478-2022**	**6/28/2003 04:00 PM**

9. ISSUED BY — CODE

Environmental Protection Agency
Contracts Management Division
4411 Montgomery Road
Norwood, OH 45212

10. THIS ACQUISITION IS

[X] UNRESTRICTED

[] SET ASIDE: % FOR
[] SMALL BUSINESS
[] SMALL DISADV. BUSINESS
[]8(A)

NAICS: **334519**
SIZE STANDARD:

11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED
[] SEE SCHEDULE

12. DISCOUNT TERMS

[] 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)

13b. RATING

14. METHOD OF SOLICITATION

[] RFQ [] IFB [X] RFP

15. DELIVER TO — CODE

16. ADMINISTERED BY — CODE

17a. CONTRACTOR/ OFFEROR — CODE — FACILITY CODE

TELEPHONE NO.

18a. PAYMENT WILL BE MADE BY — CODE

Environmental Protection Agency
Research Triangle Park Financial
Management Center (D143-02)
Research Triangle Park, NC 27711

[ ] 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER

18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED
[] SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	SEE CLINS PAGE 3-1 *(Attach Additional sheets as Necessary)*				

25. ACCOUNTING AND APPROPRIATION DATA

N/A

26. TOTAL AWARD AMOUNT *(For Govt. Use Only)*

[] 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 ARE ATTACHED. [] ARE [] ARE NOT ATTACHED.

[] 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4. FAR 52.212-5 IS ATTACHED. ADDENDA [] ARE [] ARE NOT ATTACHED.

28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN COPIES
[] TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.

29. AWARD OF CONTRACT: REFERENCE _____ OFFER
[] DATED _____. YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:

30a. SIGNATURE OF OFFEROR/CONTRACTOR

31a. UNITED STATES OF AMERICA *(SIGNATURE OF CONTRACTING OFFICER)*

30b. NAME AND TITLE OF SIGNER *(TYPE OR PRINT)* — 30c. DATE SIGNED

31b. NAME OF CONTRACTING OFFICER *(TYPE OR PRINT)*
DAVID H. PLAGGE

31c. DATE SIGNED

32a. QUANTITY IN COLUMN 21 HAS BEEN
[ ] RECEIVED [ ] INSPECTED [ ] ACCEPTED AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED

32b. SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE — 32c. DATE

33. SHIP NUMBER — PARTIAL — FINAL

34. VOUCHER NUMBER

35. AMOUNT VERIFIED CORRECT FOR

36. PAYMENT
[ ] COMPLETE [ ] PARTIAL [ ] FINAL

37. CHECK NUMBER

38. S/R ACCOUNT NUMBER

39. S/R VOUCHER NUMBER

40. PAID BY

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT

41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER — 41c. DATE

42a. RECEIVED BY *(Print)*

42b. RECEIVED AT *(Location)*

42c. DATE REC'D *(YY/MM/DD)* — 42d. TOTAL CONTAINERS

AUTHORIZED FOR LOCAL REPRODUCTION

SEE REVERSE FOR OMB CONTROL NUMBER AND PAPERWORK BURDEN STATEMENT

STANDARD FORM 1449 (10-95)
Prescribed by GSA - FAR (48 CFR) 53.212

Public reporting burden for this collection of information is estimated to average 45 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the FAR Secretariat (VRS), Office of Federal Acquisition Policy, GSA, Washington, DC 20405.	OMB NO: 9000-0136 Expires: 09/30/98

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1. CONTRACT TERMS AND CONDITIONS -- COMMERCIAL ITEMS (FAR 52.212-4) (FEB 2002) DEVIATION

(a) *Inspection/Acceptance.* The Contractor shall only tender for acceptance those items that conform to the requirements of this contract. The Government reserves the right to inspect or test any supplies or services that have been tendered for acceptance. The Government may require repair or replacement of nonconforming supplies or reperformance of nonconforming services at no increase in contract price. The Government must exercise its post-acceptance rights --

(1) Within a reasonable time after the defect was discovered or should have been discovered; and

(2) Before any substantial change occurs in the condition of the item, unless the change is due to the defect in the item.

(b) *Assignment.* The Contractor or its assignee may assign its rights to receive payment due as a result of performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency in accordance with the Assignment of Claims Act (31 U.S.C.3727). However, when a third party makes payment (e.g., use of the Governmentwide commercial purchase card), the Contractor may not assign its rights to receive payment under this contract.

(c) *Changes.* Changes in the terms and conditions of this contract may be made only by written agreement of the parties.

(d) *Disputes.* This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613). Failure of the parties to this contract to reach agreement on any request for equitable adjustment, claim, appeal or action arising under or relating to this contract shall be a dispute to be resolved in accordance with the clause at FAR 52.233-1, Disputes, which is incorporated herein by reference. The Contractor shall proceed diligently with performance of this contract, pending final resolution of any dispute arising under the contract.

(e) *Definitions.* The clause at FAR 52.202-1, Definitions, is incorporated herein by reference.

(f) *Excusable delays.* The Contractor shall be liable for default unless nonperformance is caused by an occurrence beyond the reasonable control of the Contractor and without its fault or negligence such as, acts of God or the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, unusually severe weather, and delays of common carriers. The Contractor shall notify the Contracting Officer in writing as soon as it is reasonably possible after the commencement of any excusable delay, setting forth the full

particulars in connection therewith, shall remedy such occurrence with all reasonable dispatch, and shall promptly give written notice to the Contracting Officer of the cessation of such occurrence.

(g) *Invoice.* (1) The Contractor shall submit an original invoice and three copies (or electronic invoice, if authorized) to the address designated in the contract to receive invoices. An invoice must include--

(i) Name and address of the Contractor;

(ii) Invoice date and number;

(iii) Contract number, contract line item number and, if applicable, the order number;

(iv) Description, quantity, unit of measure, unit price and extended price of the items delivered;

(v) Shipping number and date of shipment, including the bill of lading number and weight of shipment if shipped on Government bill of lading;

(vi) Terms of any discount for prompt payment offered;

(vii) Name and address of official to whom payment is to be sent;

(viii) Name, title, and phone number of person to notify in event of defective invoice; and

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision, contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(2) INVOICE PREPARATION AND SUBMISSION
Contractors shall submit invoices upon delivery and acceptance of all supplies or services unless otherwise specified in the contract. Invoices shall be submitted as follows:

(i) One (1) original and two (2) copies of the invoice to:

U.S. Environmental Protection Agency
Research Triangle Park Financial Management Center
(Mail Code 32)
Research Triangle Park, NC 27711

(ii) One (1) copy of the invoice to the Project Officer designated in the clause entitled "Contract Administration Representatives" (EP 52.242-100).

(iii) One (1) copy of the invoice to the Contracting Officer designated in the clause entitled "Contract Administration Representatives" (EP 52.242-100).

(3) Invoices will be handled in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) prompt payment regulations at 5 CFR part 1315.

(h) *Patent indemnity.* The Contractor shall indemnify the Government and its officers, employees and agents against liability, including costs, for actual or alleged direct or contributory infringement of, or inducement to infringe, any United States or foreign patent, trademark or copyright, arising out of the performance of this contract, provided the Contractor is reasonably notified of such claims and proceedings.

(i) *Payment.* Payment shall be made for items accepted by the Government that have been delivered to the delivery destinations set forth in this contract. The Government will make payment in accordance with the Prompt Payment Act (31 U.S.C. 3903) and OMB prompt payment regulations at 5 CFR part 1315. In connection with any discount offered for early payment, time shall be computed from the date of the invoice. For the purpose of computing the discount earned, payment shall be considered to have been made on the date which appears on the payment check or the specified payment date if an electronic funds transfer payment is made.

(j) *Risk of loss*. Unless the contract specifically provides otherwise, risk of loss or damage to the supplies provided under this contract shall remain with the Contractor until, and shall pass to the Government upon:

(1) Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or

(2) Delivery of the supplies to the Government at the destination

specified in the contract, if transportation is f.o.b. destination.

(k) *Taxes.* The contract price includes all applicable Federal, State, and local taxes and duties.

(l) *Termination for the Government's convenience*. The Government reserves the right to terminate this contract, or any part hereof, for its sole convenience. In the event of such termination, the Contractor shall immediately stop all work hereunder and shall immediately cause any and all of its suppliers and subcontractors to cease work. Subject to the terms of this contract, the Contractor shall be paid a percentage of the contract price reflecting the percentage of the work performed prior to the notice of termination, plus reasonable charges the Contractor can demonstrate to the satisfaction of the Government using its standard record keeping system, have resulted from the termination. The Contractor shall not be required to comply with the cost accounting standards or contract cost principles for this purpose. This paragraph does not give the Government any right to audit the Contractor's records. The Contractor shall not be paid for any work performed or costs incurred which reasonably could have been avoided.

(m) *Termination for cause.* The Government may terminate this contract, or any part hereof, for cause in the event of any default by the Contractor, or if the Contractor fails to comply with any contract terms and conditions, or fails to provide the Government, upon request, with adequate assurances of future performance. In the event of termination for cause, the Government shall not be liable to the Contractor for any amount for supplies or services not accepted, and the Contractor shall be liable to the Government for any and all rights and remedies provided by law. If it is determined that the Government improperly terminated this contract for default, such termination shall be deemed a termination for convenience.

(n) *Title.* Unless specified elsewhere in this contract, title to items furnished under this contract shall pass to the Government upon acceptance, regardless of when or where the Government takes physical possession.

(o) *Warranty.* The Contractor warrants and implies that the items delivered hereunder are merchantable and fit for use for the particular purpose described in this contract.

(p) *Limitation of liability.* Except as otherwise provided by an express warranty, the Contractor will not be liable to the Government for consequential damages resulting from any defect or deficiencies in accepted items.

(q) *Other compliances.* The Contractor shall comply with all applicable Federal, State and local laws, executive orders, rules and regulations applicable to its performance under this contract.

(r) *Compliance with laws unique to Government contracts*. The Contractor agrees to comply with 31 U.S.C. 1352 relating to limitations on the use of appropriated funds to influence certain Federal contracts; 18 U.S.C. 431 relating to officials not to benefit; 40 U.S.C. 327, et seq., Contract Work Hours and Safety Standards Act; 41 U.S.C. 51-58, Anti-Kickback Act of 1986; 41 U.S.C. 265 and 10 U.S.C. 2409 relating to whistleblower protections; 49 U.S.C. 40118, Fly American; and 41 U.S.C. 423 relating to procurement integrity.

(s) *Order of precedence.* Any inconsistencies in this solicitation or contract shall be resolved by giving precedence in the following order:

(1) The schedule of supplies/services.

(2) The Assignments, Disputes, Payments, Invoice, Other Compliances, and Compliance with Laws Unique to Government Contracts paragraphs of this clause.

(3) The clause at 52.212-5.

(4) Addenda to this solicitation or contract, including any license agreements for computer software.

(5) Solicitation provisions if this is a solicitation.

(6) Other paragraphs of this clause.

(7) The Standard Form 1449.

(8) Other documents, exhibits, and attachments.

(9) The specification.

2. CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS -- COMMERCIAL ITEMS (FAR 52.212-5) (APR 2003)

a) The Contractor shall comply with the following FAR clauses, which are incorporated in this contract by reference, to implement provisions of law or executive orders applicable to acquisitions of commercial items:

(1) 52.222-3, Convict Labor (E.O. 11755);

(2) 52.233-3, Protest after Award (31 U.S.C 3553).

(b) The Contractor shall comply with the FAR clauses in this paragraph (b) that the contracting officer has indicated as being incorporated in this contract by reference to implement provisions of law or Executive orders applicable to acquisitions of commercial items or components:

(Contracting Officer must check as appropriate.)

X (1) 52.203-6, Restrictions on Subcontractor Sales to the Government, with Alternate I (41 U.S.C. 253g and 10 U.S.C. 2402).

___ (2) 52.219-3, Notice of HUBZone Small Business Set-Aside (Jan 1999).

X (3) 52.219-4, Notice of Price Evaluation Preference for HUBZone Small Business Concerns (Jan 1999) (if the offeror elects to waive the preference, it shall so indicate in its offer).

___ (4) (i) 52.219-5, Very Small Business Set-Aside (Pub. L. 103-403, section 304, Small Business Reauthorization and Amendments Act of 1994).

___ (ii) Alternate I to 52.219-5.

___ (iii) Alternate II to 52.219-5.

X (5) 52.219-8, Utilization of Small Business Concerns (15 U.S.C. 637 (d)(2) and (3)).

___ (6) 52.219-9, Small Business Subcontracting Plan (15 U.S.C. 637 (d)(4)).

___ (7) 52.219-14, Limitations on Subcontracting (15 U.S.C. 637(a)(14)).

___ (8) (i) 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323) (if the offeror elects to waive the adjustment, it shall so indicate in its offer).

___ (ii) Alternate I of 52.219-23.

___ (9) 52.219-25, Small Disadvantaged Business Participation Program-Disadvantaged Status and Reporting (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323).

___ (10) 52.219-26, Small Disadvantaged Business Participation Program-Incentive Subcontracting (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323).

X (11) 52.222-21, Prohibition of Segregated Facilities (Feb 1999).

X (12) 52.222-26, Equal Opportunity (E.O. 11246).

X (13) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (38 U.S.C. 4212).

X (14) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793).

X (15) 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (38 U.S.C. 4212).

X (16) 52.222-19, Child Labor-Cooperation with Authorities and Remedies (E.O. 13126).

___ (17)(i) 52.223-9, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (42 U.S.C. 6962(c)(3)(A)(ii)).

___ (ii) Alternate I of 52.223-9 (42 U.S.C. 6962(i)(2)(C)).

___(18) 52.225-1, Buy American Act--Supplies (41 U.S.C. 10a-10d).

___(19)(i) 52.225-3, Buy American Act--North American Free Trade Agreement--Israeli Trade Act (41 U.S.C. 10a-10d, 19 U.S.C. 3301 note, 19 U.S.C. 2112 note).

___ (ii) Alternate I of 52.225-3.

___ (iii) Alternate II of 52.225-3.

X (20) 52.225-5, Trade Agreements (19 U.S.C. 2501, et seq., 19 U.S.C. 3301 note).

X (21) 52.225-13, Restriction on Certain Foreign Purchases (E.O. 12722, 12724, 13059, 13067, 13121, and 13129).

___ (22) 52.225-15, Sanctioned European Union Country End Products (E.O. 12849).

___ (23) 52.225-16, Sanctioned European Union Country Services (E.O.

12849).

___ (24) 52.232-33, Payment by Electronic Funds Transfer-Central Contractor Registration (31 U.S.C. 3332).

X (25) 52.232-34, Payment by Electronic Funds Transfer-Other Than Central Contractor Registration (31 U.S.C. 3332).

___ (26) 52.232-36, Payment by Third Party (31 U.S.C. 3332).

___ (27) 52.239-1, Privacy or Security Safeguards (5 U.S.C. 552a).

___ (28) (i) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (46 U.S.C. 1241).

___ (ii) Alternate I of 52.247-64.

(c) The Contractor shall comply with the FAR clauses in this paragraph (c), applicable to commercial services, which the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or executive orders applicable to acquisitions of commercial items or components:

(Contracting Officer must check as appropriate.)

___ (1) 52.222-41, Service Contract Act of 1965, As Amended (41 U.S.C. 351, et seq.).

___ (2) 52.222-42, Statement of Equivalent Rates for Federal Hires (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (3) 52.222-43, Fair Labor Standards Act and Service Contract Act -- Price Adjustment (Multiple Year and Option Contracts) (29 U.S.C.206 and 41 U.S.C. 351, et seq.).

___ (4) 52.222-44, Fair Labor Standards Act and Service Contract Act -- Price Adjustment (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (5) 52.222-47, SCA Minimum Wages and Fringe Benefits Applicable to Successor Contract Pursuant to Predecessor Contractor Collective Bargaining Agreement (CBA) (41 U.S.C. 351, et seq.).

(d) *Comptroller General Examination of Record.* The Contractor shall comply with the provisions of this paragraph (d) if this contract was awarded using other than sealed bid, is in excess of the simplified acquisition threshold, and does not contain the clause at 52.215-2, Audit and Records -- Negotiation.

(1) The Comptroller General of the United States, or an authorized

representative of the Comptroller General, shall have access to and right to examine any of the Contractor's directly pertinent records involving transactions related to this contract.

(2) The Contractor shall make available at its offices at all reasonable times the records, materials, and other evidence for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in FAR Subpart 4.7, Contractor Records Retention, of the other clauses of this contract. If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement. Records relating to appeals under the disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(3) As used in this clause, records include books, documents, accounting procedures and practices, and other data, regardless of type and regardless of form. This does not require the Contractor to create or maintain any record that the Contractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) Notwithstanding the requirements of the clauses in paragraphs (a), (b), (c) or (d) of this clause, the Contractor is not required to include any FAR clause, other than those listed below (and as may be required by an addenda to this paragraph to establish the reasonableness of prices under Part 15), in a subcontract for commercial items or commercial components --

(1) 52.222-26, Equal Opportunity (E.O. 11246);

(2) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (38 U.S.C. 4212);

(3) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793);

(4) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (46 U.S.C. Appx 1241 and 10 U.S.C. 2631) (flow down required in accordance with paragraph (d) of FAR clause 52.247-64); and

(5) 52.222-41, Service Contract Act of 1965, As Amended (41 U.S.C. 351, *et seq.*).

3. INSTRUCTIONS TO OFFERORS -- COMMERCIAL ITEMS (FAR 52.212-1) (OCT 2000) DEVIATION

(a) *North American Industry Classification System (NAICS) code and small business size standard.* The NAICS code and small business size standard for this acquisition appear in Block 10 of the solicitation cover sheet (SF 1449). However, the small business size standard for a concern which submits an offer in its own name, but which proposes to furnish an item which it did not itself manufacture, is 500 employees.

(b) *Submission of offers.* Submit signed and dated offers to the office specified in this solicitation at or before the exact time specified in this solicitation. Offers may be submitted on the SF 1449, letterhead stationery, or as otherwise specified in the solicitation. As a minimum, offers must show--

(1) The solicitation number;

(2) The time specified in the solicitation for receipt of offers;

(3) The name, address, and telephone number of the offeror;

(4) A technical description of the items being offered in sufficient detail to evaluate compliance with the requirements in the solicitation. This may include product literature, or other documents, if necessary;

(5) Terms of any express warranty;

(6) Price and any discount terms;

(7) "Remit to" address, if different than mailing address;

(8) A completed copy of the representations and certifications at FAR 52.212-3;

(9) Acknowledgment of Solicitation Amendments;

(10) Past performance information, when included as an evaluation factor, to include recent and relevant contracts for the same or similar items and other references (including contract numbers, points of contact with telephone numbers and other relevant information); and

(11) If the offer is not submitted on the SF 1449, include a statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation. Offers that fail to furnish required representations or information, or reject the terms and conditions of the solicitation may be excluded from consideration.

(c) *Period for acceptance of offers*. The offeror agrees to hold the prices in its offer firm for 60 calendar days from the date specified for receipt of offers, unless another time period is specified in an addendum to the solicitation.

(d) *Product samples*. When required by the solicitation, product samples shall be submitted at or prior to the time specified for receipt of offers. Unless otherwise specified in this solicitation, these samples shall be submitted at no expense to the Government, and returned at the sender's request and expense, unless they are destroyed during preaward testing.

(e) *Multiple offers*. Offerors are encouraged to submit multiple offers presenting alternative terms and conditions or commercial items for satisfying the requirements of this solicitation. Each offer submitted will be evaluated separately.

(f) *Late submissions, modifications, revisions, and withdrawals of offers.* (1) Offerors are responsible for submitting offers, and any modifications, revisions, or withdrawals, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that offers or revisions are due.

(2)(i) Any offer, modification, revision, or withdrawal of an offer received at the Government office designated in the solicitation after the exact time specified for receipt of offers is ``late'' and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(A) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of offers; or

(B) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(C) If this solicitation is a request for proposals, it was the only proposal received.

(ii) However, a late modification of an otherwise successful offer, that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(3) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the offer wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(4) If an emergency or unanticipated event interrupts normal Government processes so that offers cannot be received at the Government office designated for receipt of offers by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of offers will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(5) Offers may be withdrawn by written notice received at any time before the exact time set for receipt of offers. Oral offers in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile offers, offers may be withdrawn via facsimile received at any time before the exact time set for receipt of offers, subject to the conditions specified in the solicitation concerning facsimile offers. An offer may be withdrawn in person by an offeror or its authorized representative if, before the exact time set for receipt of offers, the identity of the person requesting withdrawal is established and the person signs a receipt for the offer.

(g) *Contract award (not applicable to Invitation for Bids)*. The Government intends to evaluate offers and award a contract without discussions with offerors. Therefore, the offeror's initial offer should contain the offeror's best terms from a price and technical standpoint. However, the Government reserves the right to conduct discussions if later determined by the Contracting Officer to be necessary. The Government may reject any or all offers if such action is in the public interest; accept other than the lowest offer; and waive informalities and minor irregularities in offers received.

(h) *Multiple awards*. The Government may accept any item or group of items of an offer, unless the offeror qualifies the offer by specific limitations. Unless otherwise provided in the Schedule, offers may not be submitted for quantities less than those specified. The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit prices offered, unless the offeror specifies otherwise in the offer.

(i) Availability of requirements documents cited in the solicitation.
(1)(i) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29, and copies of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained for a fee by submitting a request to--

GSA Federal Supply Service Specifications Section,
Suite 8100,
470 East L'Enfant Plaza, SW, Washington, DC 20407,
Telephone (202) 619-8925,
Facsimile (202) 619-8978.

(ii) If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (i)(1)(i) of this provision. Additional copies will be issued for a fee.

(2) The DoD Index of Specifications and Standards (DoDISS) and documents listed in it may be obtained from the--

Department of Defense Single Stock Point (DoDSSP),
Building 4, Section D,
700 Robbins Avenue,
Philadelphia, PA 19111-5094,
Telephone (215) 697- 2667/2179,
Facsimile (215) 697-1462.

(i) Automatic distribution may be obtained on a subscription basis.

(ii) Order forms, pricing information, and customer support information may be obtained--

(A) By telephone at (215) 697-2667/2179; or

(B) Through the DoDSSP Internet site at http://assist.daps.mil.

(3) Nongovernment (voluntary) standards must be obtained from the organization responsible for their preparation, publication, or maintenance.

(j) Data Universal Numbering System (DUNS) Number. (Applies to offers exceeding $25,000.) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation ‘‘DUNS’’ followed by the DUNS number that identifies the offeror’s name and address. If the offeror does not have a DUNS number, it should contact Dun and Bradstreet to obtain one at no charge. An offeror within the United States may call 1-800-333-0505. The offeror may obtain more information regarding the DUNS number, including locations of local Dun and Bradstreet Information Services offices for offerors located outside the United States, from the Internet home page at http://www.customerservice@dnb.com. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

4. EVALUATION -- COMMERCIAL ITEMS (FAR 52.212-2) (JAN 1999)

(a) The Government will award a contract resulting from this solicitation to the responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, price and other factors considered. The following factors shall be used to evaluate offers:

SEE ATTACHMENT 4

Technical and past performance, when combined, are more important than price

(b) *Options*. The Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. The Government may determine that an offer is unacceptable if the option prices are significantly unbalanced. Evaluation of options shall not obligate the Government to exercise the option(s).

(c) A written notice of award or acceptance of an offer, mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer, shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award.

5. OFFEROR REPRESENTATIONS AND CERTIFICATIONS -- COMMERCIAL ITEMS (FAR 52.212-3) (JUL 2002)

(a) *Definitions.* As used in this provision:

"Emerging small business" means a small business concern whose size is no greater than 50 percent of the numerical size standard for the NAICS code designated.

"Forced or indentured child labor" means all work or service-

(1) Exacted from any person under the age of 18 under the menace of any penalty for its nonperformance and for which the worker does not offer himself voluntarily; or

(2) Performed by any person under the age of 18 pursuant to a contract the enforcement of which can be accomplished by process of penalties.

"Service-disabled veteran-owned small business concern"-

(1) Means a small business concern-

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern" means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and size standards in this solicitation.

"Veteran-owned small business concern" means a small business concern-

(1) Not less than 51 percent of which is owned by one or more veterans(as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned business concern" means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

"Women-owned small business concern" means a small business concern --

(1) That is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(b) *Taxpayer identification number (TIN) (26 U.S.C. 6109, 31 U.S.C. 7701)*. (Not applicable if the offeror is required to provide this information to a central contractor registration database to be eligible for award.)

(1) All offerors must submit the information required in paragraphs (b)(3) through (b)(5) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the Internal Revenue Service (IRS).

(2) The TIN may be used by the government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.]

(3) Taxpayer Identification Number (TIN).

[ ] TIN:_____.

[ ] TIN has been applied for.

[ ] TIN is not required because:

[ ] Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

[ ] Offeror is an agency or instrumentality of a foreign government;

[ ] Offeror is an agency or instrumentality of the Federal Government;

(4) Type of organization.

[ ] Sole proprietorship;

[ ] Partnership;

[ ] Corporate entity (not tax-exempt);

[ ] Corporate entity (tax-exempt);

[ ] Government entity (Federal, State, or local);

[ ] Foreign government;

[ ] International organization per 26 CFR 1.6049-4;

[ ] Other _____.

(5) Common parent.

[ ] Offeror is not owned or controlled by a common parent:

[ ] Name and TIN of common parent:

Name _____

TIN _____

(c) Offerors must complete the following representations when the resulting contract is to be performed inside the United States, its territories or possessions, Puerto Rico, the Trust Territory of the Pacific Islands, or the District of Columbia. Check all that apply.

(1) *Small business concern.* The offeror represents as part of its offer that it [ ]is, [ ]is not a small business concern.

(2) *Veteran-owned small business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents as part of its offer that it [ ]is, [ ]is not a veteran-owned small business concern.

(3) Service-disabled veteran-owned small business concern. [Complete only if the offeror represented itself as a veteran-owned small business

concern in paragraph (c)(2) of this provision.] The offeror represents as part of its offer that it [ ]is, [ ]is not a service-disabled veteran-owned small business concern.

(4) *Small disadvantaged business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents, for general statistical purposes, that it [ ]is, [ ]is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(5) *Women-owned small business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents that it [ ]is, [ ]is not a women-owned small business concern.

Note: Complete paragraphs (c)(6) and (c)(7) only if this solicitation is expected to exceed the simplified acquisition threshold.

(6) *Women-owned business concern (other than small business concern). [Complete only if the offeror is a women-owned business concern and did not represent itself as a small business concern in paragraph (c)(1) of this provision.]*. The offeror represents that it [ ]is, a women-owned business concern.

(7) *Tie bid priority for labor surplus area concerns.* If this is an invitation for bid, small business offerors may identify the labor surplus areas in which costs to be incurred on account of manufacturing or production (by offeror or first-tier subcontractors) amount to more than 50 percent of the contract price:

_____

(8) Small Business Size for the Small Business Competitiveness Demonstration Program and for the Targeted Industry Categories under the Small Business Competitiveness Demonstration Program. *[Complete only if the offeror has represented itself to be a small business concern under the size standards for this solicitation.]*

(i) *[Complete only for solicitations indicated in an addendum as being set-aside for emerging small businesses in one of the four designated industry groups (DIGs).]* The offeror represents as part of its offer that it [ ]is, [ ]is not an emerging small business.

(ii) *[Complete only for solicitations indicated in an addendum as being for one of the targeted industry categories (TICs) or four designated industry groups (DIGs).]* Offeror represents as follows:

(A) Offeror's number of employees for the past 12 months (check the Employees column if size standard stated in the solicitation is expressed in terms of number of employees); or

(B) Offeror's average annual gross revenue for the last 3 fiscal years (check the Average Annual Gross Number of Revenues column if size standard stated in the solicitation is expressed in terms of annual receipts).

(Check one of the following):

Number of Employees	**Average Annual Gross Revenues**
___ 50 or fewer	___$1 million or less
___ 51-100	___$1,000,001-$2 million
___101-250	___$2,000,001-$3.5 million
___251-500	___$3,500,001-$5 million
___501-750	___$5,000,001-$10 million
___751-1,000	___$10,000,001-$17 million
___Over 1,000	___Over $17 million

(9) *[Complete only if the solicitation contains the clause at FAR 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns, or FAR 52.219-25, Small Disadvantaged Business Participation Program-Disadvantaged Status and Reporting, and the offeror desires a benefit based on its disadvantaged status.]*

(i) *General.* The offeror represents that either-

(A) It [ ]is, [ ]is not certified by the Small Business Administration as a small disadvantaged business concern and identified, on the date of this representation, as a certified small disadvantaged business concern in the database maintained by the Small Business Administration (PRO-Net), and that no material change in disadvantaged ownership and control has occurred since its certification, and, where the concern is owned by one or more individuals claiming disadvantaged status, the net worth of each individual upon whom the certification is based does not exceed $750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); or

(B) It [ ]has, [ ]has not submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR 124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted.

(ii) [ ]*Joint Ventures under the Price Evaluation Adjustment for Small Disadvantaged Business Concerns.* The offeror represents, as part of its

offer, that it is a joint venture that complies with the requirements in 13 CFR 124.1002(f) and that the representation in paragraph (c)(9)(i) of this provision is accurate for the small disadvantaged business concern that is participating in the joint venture. *[The offeror shall enter the name of the small disadvantaged business concern that is participating in the joint venture:* _____.]

(10) *HUBZone small business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents, as part of its offer, that--

(i) It [ ] is, [ ] is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It [ ] is, [ ] is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (c)(10)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. *[The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:*_____*.]* Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(d) *Representations required to implement provisions of Executive Order 11246* --(1) Previous contracts and compliance. The offeror represents that --

(i) It [ ]has, [ ]has not, participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation; and

(ii) It [ ]has, [ ]has not, filed all required compliance reports.

(2) Affirmative Action Compliance. The offeror represents that --

(i) It [ ]has developed and has on file, [ ]has not developed and does not have on file, at each establishment, affirmative action programs required by rules and regulations of the Secretary of Labor (41 CFR parts 60-1 and 60-2), or

(ii) It [ ]has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

(e) *Certification Regarding Payments to Influence Federal Transactions (31 U.S.C. 1352).* (Applies only if the contract is expected to exceed $100,000.)

By submission of its offer, the offeror certifies to the best of its knowledge and belief that no Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with the award of any resultant contract.

(f) *Buy American Act Certificate.* (Applies only if the clause at Federal Acquisition Regulation (FAR) 52.225-1, Buy American Act--Supplies, is included in this solicitation.)

(1) The offeror certifies that each end product, except those listed in paragraph (f)(2) of this provision, is a domestic end product (as defined in the clause of this solicitation entitled "Buy American Act--Supplies") and that the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States. The offeror shall list as foreign end products those end products manufactured in the United States that do not qualify as domestic end products.

(2) Foreign End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(3) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25.

(g)(1) *Buy American Act -- North American Free Trade Agreement -- Israeli Trade Act Certificate.* (Applies only if the clause at FAR 52.225-3, Buy American Act – North American Free Trade Agreement Israeli Trade Act, is included in this solicitation.)

(i) The offeror certifies that each end product, except those listed in paragraph (g)(1)(ii) or (g)(1)(iii) of this provision, is a domestic end product as defined in the clause of this solicitation entitled "Buy American Act -- North American Free Trade Agreement -- Israeli Trade Act" and that the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States.

(ii) The offeror certifies that the following supplies are NAFTA country end products or Israeli end products as defined in the clause of this solicitation entitled "Buy American Act-North American Free Trade

Agreement-Israeli Trade Act":

NAFTA Country or Israeli End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(iii) The offeror shall list those supplies that are foreign end products (other than those listed in paragraph (g)(1)(ii) or this provision) as defined in the clause of this solicitation entitled "Buy American Act-North American Free Trade Agreement-Israeli Trade Act." The offeror shall list as other foreign end products those end products manufactured in the United States that do not qualify as domestic end products.

Other Foreign End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(iv) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25.

(2) *Buy American Act--North American Free Trade Agreements--Israeli Trade Act Certificate, Alternate I (May 2002)*. If Alternate I to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Canadian end products as defined in the clause of this solicitation entitled ``Buy American Act--North American Free Trade Agreement--Israeli Trade Act'':

Canadian End Products:

Line Item No.

_____

_____

_____

(List as necessary)

(3) Buy American Act--North American Free Trade Agreements--Israeli Trade Act Certificate, Alternate II (May 2002). If Alternate II to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Canadian end products or Israeli end products as defined in the clause of this solicitation entitled ``Buy American Act--North American Free Trade Agreement-Israeli Trade Act'':

Canadian or Israeli End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(4) *Trade Agreements Certificate.* (Applies only if the clause at FAR 52.225-5, Trade Agreements, is included in this solicitation.)

(i) The offeror certifies that each end product, except those listed in paragraph (g)(4)(ii) of this provision, is a U.S.-made, designated country, Caribbean Basin country, or NAFTA country end product, as defined in the clause of this solicitation entitled “Trade Agreements.”

(ii) The offeror shall list as other end products those end products that are not U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products.

Other End Products

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____

_____	_____

[List as necessary]

(iii) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25. For line items subject to the Trade Agreements Act, the Government will evaluate offers of U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products without regard to the restrictions of the Buy American Act. The Government will consider for award only offers of U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products unless the Contracting Officer determines that there are no offers for such products or that the offers for such products are insufficient to fulfill the requirements of the solicitation.

(h) *Certification Regarding Debarment, Suspension or Ineligibility for Award (Executive Order 12549)*. (Applies only if the contract value is expected to exceed the simplified acquisition threshold.) The offeror certifies, to the best of its knowledge and belief, that the offeror and/or any of its principals--

(1) [ ]Are, [ ]are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency; and

(2) [ ]Have, [ ]have not, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a Federal, state or local government contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(3) [ ]Are, [ ]are not presently indicted for, or otherwise criminally or civilly charged by a Government entity with, commission of any of these offenses.

(i) *Certification Regarding Knowledge of Child Labor for Listed End Products (Executive Order 13126). [The Contracting Officer must list in paragraph (i)(1) any end products being acquired under this solicitation that are included in the List of Products Requiring Contractor Certification as to Forced or Indentured Child Labor, unless excluded at 22.1503(b).]*

(1) *Listed End Product*

Listed End Product	Listed Countries of Origin:
_____	_____

(2) *Certification. [If the Contracting Officer has identified end products and countries of origin in paragraph (i)(1) of this provision, then the offeror must certify to either (i)(2)(i) or (i)(2)(ii) by checking the appropriate block.]*

[ ] (i)The offeror will not supply any end product listed in paragraph (i)(1) of this provision that was mined, produced, or manufactured in the corresponding country as listed for that product.

[ ](ii) The offeror may supply an end product listed in paragraph (i)(1) of this provision that was mined, produced, or manufactured in the corresponding country as listed for that product. The offeror certifies that is has made a good faith effort to determine whether forced or indentured child labor was used to mine, produce, or manufacture any such end product furnished under this contract. On the basis of those efforts, the offeror certifies that it is not aware of any such use of child labor.

ATTACHMENT 1

ADDENDUM TO FAR CLAUSE 52.212-4

1. OPTION TO EXTEND THE TERM OF THE CONTRACT (FAR 52.217-9) (MAR 2000)

(a) The Government may extend the term of this contract by written notice to the Contractor 5 days; provided that the Government gives the Contractor a preliminary written notice of its intent to extend at least 30 days before the contract expires. The preliminary notice does not commit the Government to an extension.

(b) If the Government exercises this option, the extended contract shall be considered to include this option clause.

(c) The total duration of this contract, including the exercise of any options under this clause, shall not exceed four years and nine months.

(d) If an option is not exercised for either Remedial or Preventative Maintenance in a certain period, then that option is no longer available for exercise in future years. For example, if the Preventative Maintenance Option is not exercised in Option Period 2, then that Option is NOT AVAILABLE in Option Period 3.

2. PERIOD OF PERFORMANCE (EP 52.212-140) (APR 1984)

The period of performance of this contract shall be from award through 25 months after award inclusive of all required reports.

3. TECHNICAL QUESTIONS (EP 52.215-110) (APR 1984)

Offerors must submit all technical questions concerning this solicitation in writing to the contract specialist. EPA must receive the questions no later than 10 calendar days after the date of this solicitation. EPA will answer questions which may affect offers in an amendment to the solicitation. EPA will not reference the source of the questions.

4. CONTRACT ADMINISTRATION REPRESENTATIVES (EP 52.242-100) (AUG 1984)

Project Officer(s) for this contract:

Project Officer:

TO BE IDENTIFIED AT TIME OF CONTRACT AWARD

Contract Specialist(s) responsible for administering this contract:

Administrative Contracting Officer:

TO BE IDENTIFIED AT TIME OF CONTRACT AWARD

5. SITE VISIT ARRANGEMENTS AND AVAILABILITY (GSA T024) (JUL 1994)

Offerors are encouraged to inspect Government facilities that may be used for placement of equipment.

A site visit will be held on June 10, 2003 at 1:00pm. The site visit will be held at the following location:

US EPA NVFEL
2565 Plymouth Road
Ann Arbor MI 48105

All arrangements to inspect these facilities must be made in writing no later than June 6, 2003. Attendees for the site visit should be listed in vendor’s request. Arrangements shall be made with:

US EPA Cincinnati Procurement Operations Division
Mr. David Plagge
(513) 487-2022 Telephone
(513) 487-2107 Fax
plagge.david@epa.gov

ATTACHMENT 2

STATEMENT OF WORK

Statement of Work

Medium Duty
Four Wheel Drive Dynamometer
for EPA-NVFEL

Requirements, Functional Specifications,
Performance Criteria, and Acceptance Tests

U. S. Environmental Protection Agency
National Vehicle and Fuel Emissions Laboratory
2565 Plymouth Road
Ann Arbor, Michigan 48105

Table of Contents

6.0 Warranty

7.0 Training

8.0 Optional Items

Figures and Tables

Appendices

1.0 Overview and General Requirements

Section 1 provides an overview of the scope of the project and general requirements of the equipment being procured.

Specific references, which provide important technical information or guidance, are listed in Section 1.1. Where noted, the requirements of some documents are incorporated by reference as requirements of this Statement of Work. Background information is presented in Section 1.2.

A general description of the equipment covered by this Statement of Work, and associated requirements, is presented in Section 1.3. Other general requirements are covered in the balance of Section 1, including requirements for project management.

Contract deliverables and specific requirements are addressed in detail in subsequent sections of the Statement of Work.

Definitions of the acronyms used in this document are shown in the Appendix A.

Proposal instructions are found in Attachment 3 of the Request for Proposal. Following these instructions carefully, and considering the Technical Evaluation Criteria presented in Attachment 4, are critical steps to preparing a responsive proposal.

1.1 References

1.1.1 Code of Federal Regulations 40 CFR, Part 86 "Control of Emissions From New and In-Use Highway Vehicles and Engines," Subparts B, R, S

1.1.2 Code of Federal Regulations 40 CFR, Part 600, "Fuel Economy of Motor Vehicles"

1.1.3 Code of Federal Regulations 29 CFR Part 1910 "Occupational Safety and Health Standards"

All CFR materials may be found at http://www.access.gpo.gov/ecfr/

1.1.4 ISO DIS 17025 - General Requirements for the Competence of Testing and Calibration Laboratories
(www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=30239)

1.1.5 NFPA 70 (NEC), NFPA 79 (ESIM), NFPA 496 (SPPEEE) - National Electrical Codes (www.nfpa.org)

1.1.6 SAE Recommended Practices J-2263 (10/96), J-2264 (4/95), and J2452 (6/99) (www.SAE.com)

1.1.7 EPA Facilities Manual dated February, 1998 - Volume 1 (A/E&Planning Guidelines) and Volume 4 (4844 - Facility Safety, Health and Environmental Management Manual)

1.1.8 Dynamometer Performance Evaluation and Quality Assurance Procedures, AAMA/AIAM Commonization Team final draft of March 17, 2000. 132 page.doc file (Use For Informational Purposes)

All references shall be the most current available as of the date of this contract.

1.2 Background and Procurement Overview

1.2.1 As part of the Clean Air Act and its Amendments, a variety of new emissions regulations have been implemented for vehicles and engines. Tier 2, NLEV, OBD II on-board diagnostics, and Supplemental FTP are a few examples of test changes that require sophisticated and adaptable emission measurement systems. The EPA NVFEL has undertaken a comprehensive program to implement new and refined test systems to enhance the capabilities to conduct low level emissions testing, of the highest precision and accuracy, on a broad range of vehicles.

1.2.2 This document describes sets forth EPA's requirements for a 4 wheel drive electric chassis dynamometer to be located in a newly-developed test site at the EPA National Vehicle and Fuel Emissions Laboratory (NVFEL) in Ann Arbor, Michigan.

1.2.3 Federal regulations for exhaust emissions and fuel economy of motor vehicles specify tests using chassis dynamometers. The purpose of the chassis dynamometer is to duplicate the forces encountered by a vehicle moving on a road by modeling those characteristics with a stationary vehicle on a rotating surface. The dynamometer specified in this SOW will provide EPA with additional testing capabilities to support both current and future regulations as well as a range of evaluation and development activities. This dynamometer will be used to test a wide range of vehicles including front wheel drive, rear wheel drive, four wheel drive and all wheel drive with the full range of powertrain technology including those providing energy conservation through regenerative braking. These vehicles will include those powered by some combination of internal combustion engines, electric motors and storage devices, hydraulics and hydraulic storage systems and fuel cells.

1.2.4 The dynamometer shall incorporate the following general features for testing these vehicles:

1.1.1 Accurate and precise road load determination and simulation, utilizing the latest technology, through a digitally-controlled, electrically-activated, motor-absorber that recreates the mechanical inertia and frictional forces that would be present on the road with electrically generated load forces based on specific equations, coefficients, and response characteristics.

- Vehicle loading applied to the tires by 48" diameter rolls connected to intermediate motor/absorbers on a per axle configuration that contacts each vehicle tire.

- Capability of testing all light duty vehicles, medium-duty passenger vehicles and complete heavy duty vehicles up to 14,000 GVW, in two wheel drive and four wheel drive configurations, in a weight range of 1,000 to 14,000 pounds. Vehicle testing shall

be accomplished by simulating all load conditions that the vehicle can experience on a dry smooth road. Hence, the roll sets shall operate with synchronous speeds in order to simulate conditions that would reasonably occur on the road.

- Operation under various ambient conditions to provide maximum flexibility and ease of operation.

1.2.5 The chassis dynamometer shall conform to the requirements specified herein. For the equipment specified, the contractor shall have total system responsibility, which shall include all phases of the project, configuration, design, fabrication, assembly, integration, quality assurance, delivery to EPA-NVFEL, installation, calibration, commissioning, acceptance testing, documentation, and training of EPA staff. The contractor shall be responsible for documenting measurement traceability and system acceptance in a manner suitable for audit to ISO standards.

1.3 General Description of Test Site and Measurement System

1.3.1 D329 Light/Medium Duty, FWD/RWD/4WD Test Site Overview

This will be a new test site at NVFEL, intended to provide a wide range of test capabilities. It will house a medium duty / 4 wheel drive dynamometer intended to test a wide range of vehicles with from 1,000 to 14,000 pounds of simulated inertia, with single or dual drive axles, fueled by gasoline, oxygenated fuels, alcohol fuels, gaseous fuels and diesel fuel. The emission measurement system at this site shall support protocols such as Tier2 level FTP, US06, SC03, HFET and others.

Test site D329 is a room measuring nominally 25' W x 75' L x 24' H with a clear height of 20' to the bottom of the 4' girder trusses. This room will contain a dynamometer pit that has inside dimensions of 15' W x 55' L x 9' D located about 10 feet from each end. This pit contains a 24" thick reinforced floor capable of supporting the dynamometer machinery. Columns for a structural mezzanine to support sampling and auxiliary equipment will be located above the pit wall will measure about 32' L x 24' W x 12' H. The bargrate deck elevation will be at 13 feet with open web joist supports between main North-South beams supported by the columns. The clear height of this structure will be 11' 8" and will have a load rating of 150 PSF. The edge of the pit will have a 10" x 4" ledge with embedded 4x4 angle iron edges to suppport the dyno deck structure. This pit is being constructed as part of the facility modifications and will be complete before the dynamometer arrives.

Adjacent to D329 is a 20' x 25' x 10' control room that will have a concrete structural deck surface for equipment. This area includes four separate small rooms (about 5’x5’) for gas cylinder storage along the south wall. The walls of the control room will be concrete block. Access to this pit, deck, and the test cell mezzanine are provided by staircases as illustrated in Figure 2. The distance from the rear of the RWD dynamometer to the back wall of the pit shall be at least 16 feet and shall be preserved as clear space for future use. The distance from the front of the FWD dynamometer at its maximum wheelbase setting to the front wall of the pit shall be at least 10 feet and shall be preserved as clear space for future use.

Figure 2 also shows the possible location of a future 72" diameter set of rolls that could be configured as two inverted AC motor/roll assemblies. This system would be used to test large trucks with dual tandem axles. The ability of the controls and power converters provided for the MDV 4WD systems provided under this contract to be adapted and shared or switched to operate these larger roll sets would be a desirable feature. The rolls/motors of the future dynamometer would be configured to be independent, but with synchronous speed control and loading as provided by the drive and control systems for the MDV 4WD system provided

under this contract.

Construction of this new test facility began on April 2, 2003 with a projected completion date of January, 2004. We expect that the facility will be available for dynamometer installation by March 2004. Some work related to equipment installation could potentially begin prior to that date by special arrangement.

1.4 Safety, Health and Environmental Provisions

1.4.1 Providing for a safe working environment is the highest priority in all EPA equipment purchases and installation activity. The contractor shall abide and comply with all building and safety codes specified in the EPA Facility Manual and by ASME, AISC, NEC, OSHA, BOCA, and NFPA wherever they might apply, to create an intrinsically safe system and work environment.

1.4.2 Significant risk factors such as noise, ventilation of toxic gases, heated surfaces, electrical shock, and safety interlocks to prevent accidental errors shall be considered, and control measures to ensure the safety of operations and maintenance personnel shall be implemented wherever feasible.

1.4.3 As required by OSHA, all equipment shall be designed to provide for straightforward lockout protection in accordance with OSHA regulations. Written lockout instructions, in hard copy and electronic formats, shall be provided as part of the "as installed" documentation package.

1.4.4 Noise or vibration from equipment installed as part of this contract shall not penetrate the building or cause adverse affects on other equipment in the facility. Sound dampening/suppression devices and/or materials shall be installed as needed to limit noise levels to 60db at 10 feet from any devices to be located outside of the test cell, 75db at 10 feet for devices located in the test cell. Devices to be located in the control room must meet the 60db requirement.

1.4.5 The contractor shall consider energy efficiency in all component selection, system design and operational strategies. Energy efficient equipment, such as those with the "Energy Star" designation shall be utilized whenever possible.

1.4.6 The contractor shall consider the minimization of the generation and release of harmful materials to the environment in all component selection, system design, and operational strategies and installation requirements.

1.4.7 The contractor shall provide the NVFEL Project Officer with a complete list of chemicals to be utilized during installation and commissioning operations at NVFEL, and their associated Material Safety Data Sheets (MSDS), at least four weeks prior to system installation.

1.5 Quality Provisions

1.5.1 The EPA is seeking to purchase a dynamometer system that will perform and collect data at the highest precision and accuracy with a high level of certainty, in a manner that can be comprehensively demonstrated and documented. All equipment and all functions performed by the dynamometer system must be in accordance with the vehicle emissions testing and fuel economy-testing requirements of the Code of Federal Regulations and all other codes, standards, practices, etc. included by reference therein or elsewhere in this document.

1.5.2 The contractor shall be expected to carefully consider all requirements referenced in this Statement of Work, and all other documents incorporated by reference, and design a complete and efficient quality strategy for ensuring that all products delivered as part of this contract meet those requirements, and will continue to meet them on an on-going basis. This strategy is expected to include automated pre-test and post-test checks, diagnostic checks, real-time condition monitoring and exception reporting, routine maintenance activities, mistake-proofing and full documentation of NIST traceability where applicable.

The utilization of trend analysis and statistical process control, based on historical data, to alert operator to abnormal conditions, is highly desirable.

1.5.3 All documentation and system instructional, alarm and warning messages shall be delivered in a clear, concise manner, in plain English, with a minimum of technical jargon.

1.5.4 Systems delivered under this contract are expected to support compliance with ISO 9000 series standards, and ISO DIS 17025, in a complete and efficient manner.

1.5.5 The contractor shall provide automated systems which monitor and track long term performance of key operating parameters to provide early warning of failure or significant change in operating or measurement performance. The utilization of trend analysis and statistical process control, based on historical data, to alert operator to abnormal conditions, is highly desirable.

1.5.6 The contractor shall deliver systems which provide for automated archiving of active as well as previous, or inactive calibration and verification data.

1.5.7 The contractor shall provide a procedure for an automated verification of the calibration of all analog transducers and signal conditioning hardware and analog inputs and outputs delivered as part of this contract.

1.5.8 Within the context of this Statement of Work the word "calibration" shall mean:

Calibration - set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or reference material, and the corresponding values realized by standards. (International Vocabulary of Basic and General Terms in Metrology (VIM; 1993) definition) Furthermore "calibration" shall mean a defined set of actions which produce a permanent record of the relation of instrument response to standards.

1.5.9 The delivered systems shall not update any calibration data or other constants that affect dynamometer performance without first explicitly verifying via a dialog box that the action should occur. If the update is affirmed, the update shall be implemented immediately without having to reload any portion of the system or take other further action of any kind.

The update verification dialog box shall prompt for an operator ID and provide for operator comments, if any. These updates shall be permanently and centrally documented in an electronic file which stores the old information and new information as part of a clear audit trail. The update documentation file shall be readily accessible, printable, archiveable, and copyable, and shall provide for additional comments, which may be added at any time at the highest level of password protection.

This update function shall be available both "real-time," such as immediately following a calibration procedure, or at a later time, and shall include the option for additional control through the use of a special entry code. Activation of the access code option shall only restrict actual change implementation. Changes may be stored as "pending" for later implementation. All pending changes shall be easily retrievable for later authorization via a screen-viewable and printable listing. Only one calibration for any device and range shall be allowed to be "pending" at one time.

At a minimum, each record in the documentation file shall include a unique serial number, a clear description of the action taken, with change time and date, the resulting data change, operator ID, comments, and verification code (if any).

1.5.10 The contractor shall provide all certificates of calibrations and verification measures. This shall include dead weight certification, and verifications of any frequency, voltage, and mechanical attributes such as hardness, roughness, weights, dimensions, inertia, concentricities, and balance determinations.

1.6 Operational Efficiency

1.6.1 The EPA seeks to maximize value in all its testing operations, and expects the dynamometer system delivered as part of this contract to demonstrate a high level of efficiency. The contractor shall consider operational efficiency in all aspects of the design and functioning of the dynamometer. A simple example would be to provide for unattended operation of certain lengthy procedures.

1.6.2 The equipment shall be designed and configured to function satisfactorily for extended periods on a continuous basis, except for scheduled maintenance. Scheduled maintenance requirements should be minimized.

1.6.3 The measurement system shall be designed and configured to facilitate safe, one-person set-up and test operation.

1.6.4 All components of the systems specified in this contract must be free of any date-based obsolescence (e.g. "Y2K") problem that would impair operational efficiency or veracity through the year 2050.

1.7 Electrical Requirements

1.7.1 Reserved

1.7.2 Electrical power shall be provided by EPA to within 50 feet of the point of use.

The EPA will provide the following 3 types of power panels, as required, within 50 feet of the point of use. Motor and other noisy loads will not be allowed on the clean power grid.

- 208V/120V, 1 phase, 60 Hz, utility grade power
- 480V/277V, 3 phase, 60 Hz, utility grade power
- 208V/120V, 1 phase, 60 Hz, clean, uninterruptible power

1.7.3 All equipment shall be installed in accordance with the 2002 edition of NFPA 70, National Electrical Code and required local codes.

1.7.4 Equipment design and installation shall permit operation in compliance with Occupational Safety & Health Administration (OSHA) Standards Part Number 1910. Electrical equipment shall comply with Part 1910 Subpart S. See also NFPA 496.

1.7.5 Equipment design and installation shall be in compliance with 2000 edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.7.6 Equipment design and installation shall provide energy-isolating devices required for equipment operators to follow the OSHA rule on the Control of Hazardous Energy (Lockout/Tagout) of Title 29 of the Code of Federal Regulations (29 CFR) Part 1910.147.

1.7.7 All electrical cables shall be isolated from gas lines.

1.7.8 The contractor is responsible for providing and installation of all power circuits disconnects, transformers, circuit protection devices, and associated hardware required to interface with EPA provided power panels of paragraph 1.7.2.

1.7.9 All power receptacles shall be heavy duty, industrial grade. Spare power receptacles for future upgrades and maintenance shall be provided.

1.7.10 Clean/uninterruptible power outlets shall be clearly marked and in a color selected by the Project Officer.

1.7.11 Clean/uninterruptible power outlets shall be isolated from utility grade power systems and installed in accordance with the principles of IEEE Std 1100.

1.7.12 All cables external to equipment cabinets with voltages over 50V (AC or DC) shall be run in metal conduit or other EPA approved raceway.

1.7.13 Control and signal cables shall be isolated from power cables. All signal cabling shall not be adversely affected due to capacitive or inductive interference.

1.7.14 All control and signal cables/wires shall be permanently labeled with to/from and signal/function name information that corresponds with the provided electrical schematic to enable a user to determine directly the function of the cable without always having to consult a lookup table or reference a diagram.

1.7.15 All crimp or compression type connections shall use only the component manufacturer's approved crimp tools and shall follow the component manufacturer's termination instructions.

1.7.16 Discrete digital input/output (I/O) channels for external signals shall be 0 to 5 volt TTL level, unless specified otherwise and shall be optically isolated from their source. The dyno contractor shall be responsible to interface or adapt any 0-24 VDC I/O signals to other parts of the test site systems if these systems require 0-5V for the integration of functions.

1.7.17 Digital I/O communications channels shall conform to recognized industry standards such as IEEE 802, RS232, RS485, IEEE 488, IEEE 1394, or USB.

1.7.18 Analog I/O shall support ± 5 VDC, ± 10 VDC and thermocouple inputs, with appropriate signal conditioning and isolation.

1.7.19 The contractor shall provide complete electrical schematics and wire lists in their final documentation package.

1.7.20 All electrically actuated relays, solenoids, and valves shall be protected by zero switching or diode clamping so that no back EMF electrical noise is generated.

1.7.21 The electrical power driving all electrically actuated relays, solenoids, valves, and motors shall be electrically isolated and physically separated from the power source for the dynamometer control circuitry, computer, and interfaces.

1.7.22 The electrical power driving the dynamometer control circuits shall be immune to electrical

noise.

1.7.23 The dynamometer motor-generator shall feed generated electrical power back to the electrical grid via a switching device or safety string lockout that will isolate the dynamometer from the grid in the event of a power failure. The motor-absorbers shall also have current limit protection to prevent system damage from power grid faults.

1.7.24 The dynamometer system shall not feed damaging or detrimental electrical noise into the power grid. The power converter shall utilize IGBT technology and power generated back to the grid shall meet the noise and harmonic distortion requirements of IEEE-519 standards.

1.7.25 Electromagnetic fields caused by the dynamometer shall be controlled or suppressed to prevent any interference in the test vehicle or dynamometer electrical/electronic control systems. The contractor shall provide and install any isolation devices required for operation.

1.8 Project Management

1.8.1 The contractor shall comprehensively manage the project to ensure on-time completion and efficient interaction with EPA during all phases of the project. The contractor shall develop a preliminary project plan for review with EPA at a project kick off meeting. The Project Management plan shall indicate the contractor's project manager, key personnel and contact information, the project time line, and sample formats for meeting minutes, progress reports and open issue tracking. Based on the outcome of the Project Kickoff Meeting, the contractor shall deliver a complete project management plan as indicated on the Schedule of Deliverables for this contract.

1.8.2 The project management plan should also include the submissions, milestones and events to be completed no later than the dates indicated on the Schedule of Deliverables shown in Appendix F. Alternate dates for intermediate milestones may be proposed at the Project Kickoff meeting, but all modifications must be approved by the EPA Project Officer and modified in writing into the contract.

1.8.3 Basic roll operation and control functions shall be demonstrated during the off-site acceptance process. Equipment shipment to EPA shall not occur until this requirement is met. The contractor shall have responsibility for preparing a report thoroughly documenting all quality assurance activities and acceptance results.

1.8.4 The contractor shall provide on-site supervision of all installation, commissioning and acceptance activities. All contractor personnel shall receive a 1-hour briefing by EPA personnel on specific safety and security issues. All contractor personnel and subcontractor personnel must comply with EPA/NVFEL safety and security measures while working at NVFEL.

2.0 Detailed Equipment Requirements

2.1 Base Mechanical Requirements and Configuration

2.1.1 The four wheel drive dynamometer and the vehicle restraint system shall be capable of testing rear wheel drive, front wheel drive, and all wheel drive vehicles of 1,000 to 14,000 pounds inertia, in all modes of operation – FWD, RWD, or 4WD modes.

2.1.2 The dynamometer system shall consist of the following components, at a minimum, arranged in a configuration that optimizes the physical dimensions, structural integrity, system response characteristics, and flexibility to simulate various loading schemes:

- The rolls in a structure or frames suitable for this application
  The Rear Roll Dyno (RRD) shall be fixed and Front Roll Dyno (FRD) shall be movable to wheelbases of at least 86" to 230" minimum
- Pneumatic and/or hydraulic components, as required for component actuation
- Electric motor-absorber systems with all associated controls to provide vehicle inertia and road load simulation. Motors shall be located in the middle (MIM) between the left and right rollers
- Wheelbase adjustment system (automated and safety interlocked)
- Deck frame structures, decking, and automated roll slot covers capable of supporting the vehicle loads at all wheelbase settings
- All electrical cabling, piping, tubing, and cabinets
- Computer system(s) with control room and driver interface panels, pendants, displays, controls, and associated wiring and cabling
- A means to ensure safe and efficient installation, alignment, restraint, testing, and removal of the vehicle
- A user friendly vehicle restraint system to limit the dynamic lateral and fore/aft travel of the vehicle without imposing adverse forces affecting roadload forces
- T-slots (for 1" T nuts) in the deck structure for its entire length of the pit and each slot within 6" of the outside edge of the rolls for auxiliary tie down uses and to enable the possible use of existing EPA wheel chocks in 2WD modes
- Supplemental cooling devices, if required
- Safety equipment, including noise and EFI suppression
- Calibration devices

2.1.3 The contractor shall configure and install the dynamometer, decking, and related equipment in a way that optimally fulfills the various requirements of this Statement of Work, based on the

nominal test site layout shown in Figure 2.

2.1.4 The contractor shall install the dynamometers in a large subfloor pit in Room 329 at NVFEL as illustrated Figure 2. The subfloor pit construction will be provided under a separate contract and shall be coordinated for the construction and installation of this dynamometer system. The dyno pit shall be rated for Class 1, Division 2, Group D use per NFPA codes. Installation and configurations shall provide operational conditions that can be configured as intrinsically safe wherever feasible.

2.1.5 The dynamometer chassis frames shall be installed on a support base and shall provide torsional stiffness and alignment control. The frame shall withstand all static and dynamic loads which are encountered during vehicle testing, and shall not produce any vibrations which may impair the operation of the vehicle or dynamometer.

2.1.6 Fixed and movable decking shall be provided by the dynamometer contractor to completely cover the dynamometer pit. This decking shall consist of slip-resistant surfaces capable of supporting test vehicles. All deck plates shall be secure, and if moveable during dynamometer wheelbase adjustments, shall not cause any unsafe opening in the floor surface following the adjustment. The weight of a single removable deck plate shall not exceed 200 lbs. Deck plates that are heavier shall be designed to provide for some method of attaching a lifting device or chain to move them. Deck plates which need to move in conjunction with wheelbase adjustment, shall move automatically as part of that function.

2.1.7 The decking system shall include an emergency escape hatch and ladder for emergency egress from the dynamometer pit near a point that is diagonally opposite the door/stair entrance. The hatch shall require no more than 20 pounds lifting force to open. The hatch shall be prominently marked as such with a warning not to cover or block, and shall be painted “Safety Yellow” . This hatch is not intended for normal entrance and egress from the dynamometer pit.

2.1.8 The dynamometer contractor shall install appropriate lighting in the dynamometer pit sufficient for safe movement of personnel and the performance of routine maintenance functions. This lighting shall be switched at the main entrance to the dynamometer pit.

2.1.9 The dynamometer and vehicle restraint components shall be capable of withstanding shock loading from maximum acceleration/deceleration forces, such as locked vehicle brakes at 60 mph, wide open throttle (WOT), emergency shutdown, or any system malfunction(s) that induces abrupt forces, without damage to any component(s).

2.1.10 The dynamometer shall be designed and constructed to be capable of operating on a

continuous basis (24 hours per day, 7 days per week). The dynamometer shall be used to test vehicles exposed to the following ambient conditions:

- Test cell temperature: 50 - 100 degrees F
- Relative humidity: 20 to 90 %

The dynamometer performance shall not be adversely affected by the conditions of the vehicle test environment. The objective is to maintain frictional stability and to minimize component exposure to adverse conditions. Air circulation to the pit will be provided by the facility air handling system. Air flow through the pit will be approximately 10,000 CFM at test cell ambient temperature and humidity.

2.1.11 Each dynamometer roll set shall consist of two single 48 inch diameter rolls as follows: Features, functions, specifications, and criteria are also shown in Tables A and B.

- Roll diameter tolerance ± 0.010 inches
- Difference in roll diameters per roll set ± 0.010 inches
- Roll concentricity of 0.010 inches maximum Total Indicated Runout (TIR)
- Roll width spacing shall accommodate:
  Vehicle inside track width of 36 inches
  Vehicle outside track width range 100-108 inches
- Vehicle wheel base range of at least 86-230 inches as a minimum
- Constructed for vehicle axle weight of up to 10,000 pounds
- Roll surface roughness (See Note) 150-250 micro inches
- Roll surface minimum hardness Rockwell B90
- Roll dynamic balance quality to ANSI or ISO STD 1940 to G6.3
- The front and rear roll sets shall be parallel to within 0.25 inches (±0.125" on each side) as measured by the centerline differential at the maximum roll width.

NOTE: Roll surface finish shall provide a tractive effort that is comparable to a vehicle operating on a typical dry road surface with no tire slippage. Roll surface roughness shall also not produce abnormal tire tread wear. Polished rolls may slip more than dull finishes.

2.1.12 The front set of rolls shall be electro-mechanically adjustable to the vehicle wheelbase, while the rear set of rolls remains fixed. The dynamometer system shall control, indicate and automatically record the final wheelbase distance. After adjustment, the moveable roll set shall remain positively fixed on the base rail frame, even during power failures.

2.1.13 Test vehicles will be oriented as illustrated in Figure 2b. Due to the positioning of the emissions

sampling system, rear wheel drive vehicles will typically be placed on the fixed rear roll and front wheel drive vehicles will be placed on the front roll. However the dynamometer shall be configured such that either roll may be utilized for any two wheel drive vehicle.

2.1.14 The dynamometer rolls and decking shall be installed nominally flush with the level, finished floor. The vehicle shall be maintained within ± 0.5% grade of a horizontal position. (Approximately ± 0.5" per 100")

% Grade = 100 tan θ
A 45 degree slope has a grade of 100%. A 7% grade rises about 7' per 100' of travel.

2.1.15 The dynamometer frames shall be supported above the subfloor space in a manner that optimizes air circulation in the subfloor area. The test vehicle is to be approximately located at the geometric center of the air flow stream of the test chamber.

Bearings and Lubrication

2.1.16 All bearings, gears, or coupling devices shall be designed to have minimum and stabilized frictional losses.

All bearings shall have an L10 service life of at least 30,000 hours. All parts requiring lubrication shall be lubricated before delivery. All lubrication points shall be easily accessible, labeled clearly, and documented. The lubricants, lubrication system, or the dynamometer system configuration shall not generate, into the test cell 80/20 recirculating air stream, hydrocarbon emissions that would adversely affect a SULEV vehicle test at 100 °F.

2.1.17 The frictional parasitic losses of the dynamometer at all specified environmental conditions shall be stable for all modes of operation. Steady speed (50 mph) frictional losses shall remain within ± 0.1 Hp (± 1 lb) of the final stabilized value following a 10 minute warm-up period. Parasitic losses shall be stored in a data base and the ability to analyze and plot values for historical trend analysis shall be provided. Automated QC flags shall be used to warn the operator of unusual or unexpected results.

2.1.18 The bearings and power transfer loading devices shall be sized and configured to withstand the road load forces and axle loads of the specific test vehicles. These forces and loads shall include those values typically encountered from on-road vehicle performance tests conducted at wide open throttle from zero up to a maximum of 100 mph.

Wheelbase Adjustment

2.1.19 The wheelbase spacing shall be electro-mechanically adjustable to the vehicle wheelbase, in a self-powered manner. The actual wheelbase setting achieved shall be automatically indicated by an absolute or incremental measurement transducer and measurement process. The value of the final wheelbase spacing shall be electronically displayed, recorded and stored for each test. Any deck plates that need to move as part of this function shall move automatically.

2.1.20 The distance between the front and back sets of rolls shall be continuously adjustable between 86 and 230 inches with an accuracy and repeatability of ± 0.2 inches. The time required for adjusting the dynamometer to any wheelbase in the 86 to 230 inch range shall not exceed 5 minutes.

The vehicle wheelbase specification and other vehicle-specific set-up parameters, shall be available from three sources.

- Pretest information file from TDAP
- Pretest information file from the IFC
- Direct operator input

The wheelbase shall be adjustable while the dynamometer is in either 2WD or 4WD configuration, and the dynos shall be prohibited from operation during the adjustment period. Similarly, the wheelbase adjustment function shall be prohibited during all other modes of operation. A readily available means to lock out this function, in accordance with OSHA requirements shall be provided in the test cell.

2.1.21 Visual and audible alerts in the immediate vicinity of the rolls, both in the test cell and dynamometer pit, shall be activated 3 to 5 seconds prior to any wheelbase adjustments. The audible alert shall be in the range of 75 to 85 dB at a position near the rear roll.

Vehicle Restraint System

2.1.22 Separate vehicle restraint systems shall be provided for two wheel drive set-up or four wheel drive set-up, unless the use of the 4-wheel restraint system would in no way reduce the safety, efficiency or other measures of performance possible through the use of a restraint system dedicated to use in testing on a single roll.

2.1.23 Vehicle restraint systems shall be provided and installed with the dynamometer in a manner that

enables unobstructed vehicle ingress and egress from 14' x 14' rollup doors at either end of the test cell.

2.1.24 The vehicle restraint systems shall safely restrain all vehicles at all operating conditions. The vehicle restraint system shall maintain the axles of the vehicle centered on the crown of the roll(s). Wheel centering shall be set prior to the installation of the vehicle restraints.

The vehicle restraint system shall limit lateral and fore/aft motion of the vehicle frame or body to ±1 inch without imparting any adverse vertical or horizontal forces on the vehicle or vehicle tires, but allowing appropriate freedom for the vehicle suspension to move up and down.

2.1.25 The restraint system shall be easily installed, or engaged by a single operator in less than 12 minutes for four wheel drive operation or 5 minutes for two wheel drive operation. Removal of the restraint system by a single operator shall be normally accomplishable in less than 3 minutes in all situations.

Axle Centering Systems and Roll Brakes

2.1.26 A roll brake that securely locks the roll set shall be installed on each dyno. This brake shall positively separate to a non-contacting position when disengaged to assure no residual drag.

When the axle centering system and the roll brakes are actuated, installation or removal of the vehicle shall not cause roll spin. Operation of the roll brakes shall be independent of the axle centering system. The axle centering system shall be capable of being activated by a driver seated in the vehicle.

2.1.27 The axle centering system shall be operable only when the roll(s) are not rotating. A roll speed interlock system shall prevent actuating the axle centering system and non-emergency engagement of the roll brakes while the roll(s) are rotating

2.1.28 The roll brakes and axle centering system shall be replaceable within 8 hours from the start of the on-site replacement process. Replacement shall not affect calibration of the dynamometer.

Surface Treatments

2.1.29 All fixed surfaces of the dynamometer system shall be treated with highly durable protective coatings (such as plating, primers, epoxy, etc.) or made from materials that will prevent rust,

scaling, flaking, or chalking under all the operating conditions of the test cell environment.

Rotating parts such as roll(s), or shafts, and other non-paintable parts, shall be protected from corrosion by applying suitable treatments.

Deck plates shall be finished with a highly durable slip resistant coating in a color to be designated by the Project Officer.

2.1.30 Surfaces which may move, or are immediately adjacent to a moving surface, or any other surface which may pose a safety hazard, such as posts or trip hazards, shall be “Safety Yellow” in color or other color approved by the Project Officer.

2.2 Additional Safety Devices and Features

2.2.1 All safety systems for protection of personnel and equipment shall be designed in a fail-safe manner to the extent possible, and shall be immune to failure of microprocessor systems.

2.2.2 Warning lights and display messages indicating the status of the axle centering system and roll brakes, shall be visible from the driver of the vehicle, and others in the immediate vicinity of the dynamometer. An audible and visual alarm shall be activated 3 to 5 seconds prior to movement of a dynamometer roll for wheelbase length adjustment. Safety signs warning of moving rolls shall be provided for all doors into the test cell and dynamometer pit. A sign designating the meaning of warning lights shall be permanently affixed adjacent to such devices. Such signs shall be readable from a distance of approximately 12 feet.

2.2.3 The dynamometers shall be supplied with roll covers that shall automatically adjust to prohibit personnel contact with the roll(s) during vehicle testing and during dynamometer roll operation without a vehicle. All areas between the rolls shall have fixed or adjustable deck covering to provide a surface that ensures personnel safety and allows vehicle placement.

2.2.4 Emergency stop buttons shall be installed as follows:

- Near the dynamometer control computer, at the vehicle, and at the electronic and display cabinet. The vehicle-located E-stop button may be affixed to the Video Driver's Aid boom, which shall be provided by EPA as part of its VDA system.
- At the power cabinets
- At the exit door from the dynamometer pit

2.2.5 The emergency stop function shall cause shutdown (braking) of the dynamometer using the electric motor-absorber working up to the maximum current limits. In the event the electric motor-absorbers are unable to decelerate the rolls to zero, the pneumatic/hydraulic roll brakes may be used. In all cases, the rolls shall be decelerated to zero mph and stopped in a safe manner and at a nominal rate of 8 mph/sec and without damaging the dynamometer system.

Activation of the emergency stop shall cause movement of the front dyno for wheelbase adjustment and movement of any other covers or mechanical devices to immediately cease.

2.2.6 An emergency shutdown function shall be triggered automatically when any of the following conditions are exceeded for either or both sets of rolls. The system shall warn the operator and limit the operations of the machines to maintain safe conditions

- Dynamometer's maximum speed (a user specified value)
- Loss of motor control or speed or load sensor signals
- Any other condition that by design of the dynamometer would present an urgent unsafe condition in normal operation. For purposes of this requirement unsafe shall pertain to both personnel safety and the safety of critical components of the dynamometer or vehicle.

2.2.7 An emergency warning function shall be triggered automatically when any of the following conditions or limits are exceeded:

- Excessive armature or field current of the motor-absorbers
- Overheating of the motor-absorbers
- Malfunction of the dynamometer cooling systems
- Malfunction of the power transfer systems
- Loss of air handling or pit ventilation
- Other conditions needed to protect the dynamometer or personnel

As long as these conditions do not warrant an immediate shutdown of the dynamometer system, a warning of a condition that requires immediate attention shall be considered sufficient.

2.2.8 Visible and audible indicators of activation of the emergency stop function, shutdown, or warning shall be installed in the dynamometer test cell and in the dynamometer control room and powered by the uninterruptible supply. The indicators shall be operational at all times, including during power failures. The test cell indicators shall be visible from the vehicle driver's seat , when the drivers eyes are focused on the driver’s aide monitor, and in at least one other location in the test cell.

The warning shall be sufficiently prominent to capture the attention of personnel engaged in normal operational tasks. All warning devices shall include a written and graphic signs indicating their meaning, that can be read from sufficient distance as to be practical.

2.2.9 Alarm and warning messages and explanations shall also be displayed on the Dynamometer Control Computer System (DCCS) in order of occurrence and saved in a permanent log file on the control computer hard disk periodically or as needed to prevent loss from the buffer. All log file entries shall be date and time stamped. EPA’s routine computer backup and file trimming procedures normally limit the need for local storage of test log files to no more than 3 months worth of testing.

2.2.10 Alarm and warning messages shall be concise and shall provide critical information specific to

the particular condition triggering the alarm or waning.

2.2.11 The contractor shall four wheel protective barriers to contain or deflect any debris in the case of a tire failure. These devices shall also provide for attenuation of tire noise. Each barrier device shall be easily installable by a single operator in less than 2 minutes per wheel. This device shall not inhibit egress of personnel from the test cell. The use of this device, along with the restraint system, shall not prevent the removal of the vehicle from the dynamometer in under 3 minutes.

2.3 Functionality, Control and Operating Mode Requirements

2.3.1 The basic performance characteristics of the dynamometer shall be to simulate the road forces that occur on the road for any type of vehicle operation or any vehicle configuration. For example, a four wheel drive vehicle may automatically use 4WD mode during accelerations and braking, but switch to 2WD mode (FWD or RWD) during cruise modes. A hybrid vehicle may drive one or both axles with different sources of power. An engine may drive one axle and an electric motor may simultaneously absorb energy from the other, thus using the road as a power transfer path. A moment later, both may be driving the vehicle, or one axle could be mechanically braking and the other applying regenerative braking. A vehicle may have mechanical brakes on one axle and regenerative braking (but no mechanical brakes) on the other and may stop on a hill following a deceleration.

In each case and at all conditions, the displacement and speeds of the two rollers shall remain coupled in a synchronous manner as though they were two points on continuous roadbed and the two dynamometers shall correctly apply the road load forces to simulate the total load on the vehicle. The case of the vehicle stopped on a hill with no brakes on one of its axles represents the complex case of split forces at zero speed and displacement.

2.3.2 At a minimum, the dynamometer system shall support the following operation modes and functions:

- Road Load Simulation Mode (torque control mode)
  with capability for Low Power Vehicle Adjustment (Dynamic Load Reduction)
- Warm-Up Mode - parasitic loss stabilization and QC verification
- Speed Control Mode
- Torque Control Mode
- Calibration Mode
- Stepwise Coastdown - similar to SAE J2452 for tire losses as a way to quantify vehicle driveline losses on a per axle and total basis as a function of speed
- Self-Motoring Mode (steady speeds and fixed accels, decels between speeds)
- Determination of Dynamometer Parasitic Frictional Losses
- Mechanical Base Inertia Verification Test (dynamic calibration verification)
- Dynamometer Coastdown Test
- Vehicle alignment and Wheelbase adjustment Mode
- Derivation of Dynamometer Road Load Settings - SAE J2264
- Service/Diagnostic Mode

Road Load Simulation Mode

2.3.3 The contractor shall provide a dynamometer system that can be used to simulate the road forces normally encountered by FWD, RWD, AWD, or 4WD vehicles operating under a variety of conditions. Either set of rolls (front or back) shall be usable for FWD or RWD operation.

2.3.4 The system shall be capable of testing a FWD or RWD vehicle in the 4WD mode of operation whereby the rolls supporting the non-driving wheels are motored synchronous with the rolls loading the driving wheels as would occur on a flat road. In any simulation mode, either dynamometer shall also provide augmented braking, road grade simulation and low power vehicle adjustment (load reduction) as independent, selectable options.

2.3.5 The dynamometer shall simulate either a fixed or variable road grade, of at least –15% to +15%, for all vehicles up to 14,000 pounds. A fixed road grade shall be either selected and specified during the pre-test setup or from the drivers pendent. Additionally a variable road grade feature shall be selectable during pre-test setup. When a variable road grade is selected, the dynamometer shall set road grade according to an external ± 10 Volt DC signal. The scaling of this input shall be easily configurable by a user accessing the system at security level 3. Security levels are described in Section 4. The dynamometer shall limit the minimum and maximum levels of road grade simulation to user configurable limits.

2.3.6 The configuration of the dynamometer (4WD, RWD, or FWD), and as applicable, the designation of the single (Front or Rear) dynamometer roll set utilized, along with any other selectable options, shall be stored as part of the road load simulation results summary and the vehicle parameter data base.

The roll set which is not used in a 2WD configuration shall be locked using the roll brake.

2.3.7 The system shall be able to test FWD, RWD, or 4WD vehicles using a single road load curve and inertia input for the vehicle. The dynamometer control function must distribute loading to each roll set as required to simulate all transient and steady speed road conditions. Inertial forces shall be adjusted, as appropriate, for the rotational inertia of non-rotating vehicle tires in 2WD operation.

The calibration, compensation, and storage of the dynamometer parasitic losses shall be maintained in both 2WD and 4WD configurations.

2.3.8 The 4WD control system shall be designed in accordance with the following requirements with

regard to simulating actual road conditions.

- Operation in 4WD shall accurately reproduce the same proportioning of forces between the front and rear axles of the vehicle as would be encountered by driving the vehicle on a smooth, dry level road surface, for the full range of drive train designs available. This includes electric vehicles and hybrid designs that include regenerative braking, various engine-off schemes, and a range of power and traction supplementation devices and strategies. The torque split between the front and rear roll sets shall always be dictated by the vehicle, not by the dynamometer. Specifically, the tractive forces applied by the vehicle at the surfaces of each roll set and reacted to by the dyno are both inputs to and outputs from the dynamometer control system, and will change dynamically during vehicle operation.
- Front and rear roll speeds shall be synchronous within ± 0.1 mph. This translates to synchronous 48" roll displacements that remain within ± 0.2 "/sec, or ± 0.5 degrees/sec, under all 4WD operating conditions. Achievement of this requirement shall be assessed by analyzing the running 1 second average of each roll speed acquired at 20 Hz as measured by either the dynamometer roll speed sensors, or by an external high speed data acquisition device.
- The displacement of a reference point on each dyno roll surface shall also remain constant over a given test. Ideally, reference marks on each roll set should still both be in the same relative positions at the end of a test, as though the rolls were coupled mechanically. During certain modes of loading, the differential angular displacement between roll sets may vary a small amount at any given instant, but these positive and negative offsets should essentially cancel out over time.
- Front and rear roll distances shall be equivalent for all 4WD test cycles. For any test condition and duration, the front and rear roll distances shall not differ by more than 0.02% of a total distance traveled that is greater than 500 feet. Distance shall be measured per 40 CFR, Part 86, 135-90(h) by counting roll revolutions, or fractions thereof.

2.3.9 The 4WD control system shall use a high-speed control algorithm to operate the two dyno motor controllers simultaneously as follows:

- Each control system controls the loading force at the roll surface from inputs such as distance, speed, acceleration, parasitic losses, and reactive load measured from each roll set.

- The control algorithms precisely determine the applied force that will be required from both front and rear roll sets to simulate the total vehicle road load force.

- The controller shall compensate for any force simulation errors of the motor and A/C drive. One motor may be motoring and one may be absorbing or both may use any combination of these modes. The modes may also change dynamically as a function of the vehicle operation.

- The inertia and road load values shall not artificially be split between the two roll sets, nor is any assumption made as to which axle is the driving force. The rolls sets react to the inherent dynamic torque split of the vehicle power train, while maintaining the total road load, inertia force, and synchronous displacements and speeds throughout the test.

2.3.10 The load applied by the dynamometer shall model and simulate forces acting on the vehicle during normal road operation, including rolling resistance, aerodynamic drag, road grade, drive train losses and inertia forces according to the following formula:

$$FR = A + B * V + C * V^2 + D * W + M * dV / dt \quad \text{(See Note)}$$

where:

FR= total vehicle road load force to be applied at the surfaces of the rolls
A = constant load term (friction)
B = load coefficient dependent on velocity (drag and rolling resistance)
C = load coefficient dependent on velocity squared (frontal windage and drag)
D = incline grade coefficient (-,+) = [sin θ] including variable grade mode D = f(t)
W = weight of vehicle
M = effective vehicle mass, taking into account the rotational masses of driven and non-driven power trains on both 2WD and 4WD vehicles
V = linear velocity at the roller surfaces = dX / dt, where X is a point on the roll surface
dV / dt = acceleration rate of the roller surfaces

Note: The total force is the sum of the individual tractive forces applied at each roller surface. See variables and engineering units in the appendices.

2.3.11 The measured simulation error of the total road force, including the inertia force shall not exceed the greater of ± 2.0 pounds or ± 1 % of the target value, according to the above force formula, under all operating conditions and at all velocities. This measurement shall utilize the 1-second average of force and speed when acquired at 10-Hz, or faster.

2.3.12 The dynamometer control system response time shall be less than 100 milliseconds. System response time shall be defined as the time lag between a step change in demanded force at the roll surface, and the occurrence of 90% of the final demand value for a critically damped response function. The maximum overshoot shall not exceed 25% of the final steady value. The signal shall settle to within 3% of the demand value in less than 150 milliseconds from the step change. Total response shall include mechanical delay, measurement lag, computational time, and power control electrical response parameters that will be experienced in normal operation. This is illustrated in Figure 5 - Second Order Response Characteristics and Definitions.

Low Power Vehicle Adjustment (LPVA)

2.3.13 The dynamometer shall have a feature that reduces the total force applied to the vehicle under certain vehicle operating conditions, in response to external signals. LPVA shall be invoked by activation of an external 5 volt DC signal to a digital input of the dynamometer. The amount of force adjustment at any point in time shall be determined by a second, 0 to 10 volt DC signal to an analog input. Nominally this analog signal will correspond to a 0 to 100% reduction in force to the target force to be applied to the vehicle. The actual percent reduction in force, in response to this input, shall be configurable within the dynamometers maintenance or limited access set-up utilities.

Speed Control Mode

2.3.14 The dynamometer shall be capable of maintaining a vehicle at a constant speed. This function shall be controllable at the driver's pendant. A single button or simple function shall be provided to safely return the dynamometer to road load mode operation at any time.

Torque Control Mode

2.3.15 The dynamometer shall be capable of maintaining a vehicle at a constant load. This function shall be controllable at the driver's pendant. A single button or simple function shall be provided to safely return the dynamometer to road load mode operation at any time.

Self-motoring Mode

2.3.16 The motor-absorber systems shall have the capability to motor the roll sets individually or in 4WD mode under a variety of predetermined speed and load schedules. This shall allow the following procedures to be executed for either roll set, at a minimum:

- Vehicle alignment (with toggle jog or slow turning of rolls)
- Dynamometer warm-up at specified speed
- Coastdown, acceleration, and deceleration tests
- Speed signal and synchronization checks
- Parasitic loss calibration and verification
- Parasitic loss stability check
- Dynamic torque verification (also called base mechanical inertia verification)
- System response characterization

2.3.17 An acceleration/deceleration rate, plus final steady state speed and duration at that speed shall be specifiable by the operator and automatically controlled through the dynamometer controller, either as a single step or a sequence of steps. The dynamometer controller shall also be able to self-motor the dynamometer according to a 1 Hz speed versus time schedule from a time based ASCII tab delimited text file that is selectable from a menu of various schedules.

2.3.18 The motor-absorber shall be capable of accelerations and decelerations of the base mechanical inertia at any constant rate between 0 and 10 mph/sec.

Determination of Dynamometer Parasitic Frictional Losses

2.3.19 Calibration for frictional losses shall be automated. For any inertia configuration, the processor shall determine a friction curve using a steady speed or a coastdown procedure. The user shall have the capability to manually set the frictional loss coefficients. The frictional losses shall be compensated for over the entire speed range.

The frictional losses shall be modeled with a polynomial fit as follows:.

$F_o = a_o + b_o * v + c_o * v^2$ (See Note)

where:

F_o = total dynamometer frictional losses outside the force control loop
a_o = constant frictional loss coefficient

b_o = frictional loss coefficient dependent on velocity
c_o = frictional loss coefficient dependent on velocity squared
v = velocity of the roll surfaces

Note: Frictional losses shall be determined on each roll set and shall be compensated for in the total road load function. See variables and engineering units in the appendices.

Mechanical Base Inertia Verification Test

2.3.20 This function shall be available as both a verification of base inertia of each dynamometer roll set, and as a routine verification of the proper functioning of the dynamometer measurement and control systems. For this function, the dynamometer shall be programmed to operate at its base mechanical inertia weight and zero road load. From a steady lower speed (about 15 mph) and using a constant acceleration rate the dynamometer shall accelerate to a speed that is about 20 mph higher and then decelerate at the same rate back to below the lower speed. The collected force data going up and down shall be averaged to compensate for parasitic forces and then used to verify the mechanical base inertia by the following equation:

Force = (W/g)a

where:

F = Force applied at the load cell to accel/decel the roll
W = Base inertia (lbm)
g = Gravitational constant (32.174 (ft)(lbm)/(lbf)(sec^2)
a = Acceleration /Deceleration rate of the roll in ft/sec^2

Combining with g and converting acceleration units to mph/sec produces the calculated inertia:

$W_{calculated}$ = F / (0.045585 (dV/dt))

where:

0.045585 = 5280 / (3600 * 32.174)

$W_{calculated}$	=	Calculated mechanical inertia (lbm.)
F	=	average applied force ,measured by dynamometer (lbf.) over the sample interval, where the sample interval is one acceleration and one deceleration
(dV/dt)	=	Measured interval average acceleration (mph/sec)

Dynamometer and Vehicle Coastdown Test

2.3.21 The dynamometer shall perform continuous coastdown tests with incremental data collection during multiple specified speed ranges (normally 5 or 10 mph). These tests shall be performed both with and without a vehicle on the roll(s). If a vehicle is used, the transmission shall be in neutral or any regenerative braking device shall be off during the coastdown. An ABC target road load curve, the derived dyno set curve, and vehicle inertia weight to be simulated during this coastdown shall be entered. The dyno system will determine the load to be applied to achieve the total load at the roll for each speed range specified that is entered or selected from a table. The error from the target load shall be measured and calculated for each interval. A sample calculation and plot of multiple runs are shown after Figure 4.

2.3.22 During the coastdown test, the dynamometer shall achieve a stabilized speed above the specified upper speed limit (V_{upper}) and then coast down to a selectable lower speed limit (V_{lower}) under the influence of the active road load model. Speed, force, acceleration, time, and other pertinent data shall be digitally recorded or logged at the specific sampling rate (1, 10, or 20 Hz) for subsequent analysis. The nominal values used and covered for these coastdowns are as follows.

- The maximum V_{upper} shall be 100.0 mph.
- The minimum V_{lower} shall be 5.0 mph.
- The speed interval, $V_{interval}$, shall be selectable at 5.0 mph or 10.0 mph.
- The coastdown range is V_{upper} to V_{lower}.

The number of coastdowns to be performed shall be selectable by the operator from 1 to 10 runs. Refer to SAE J2264 and J2452 for additional information and details.

2.3.23 Once the above parameters have been determined and selected, the operator shall be presented with an option to save the coastdown setup under a unique name, so that the setup may be recalled at any time in the future. In addition, the DCCS (see 2.4) shall allow for a specific setup to be enabled as the “default” setup each time a coastdown test is invoked.

2.3.24 For each coastdown, the following values shall be measured at the required resolution and frequency, displayed, recorded, and stored by the DCCS for each roll set at a minimum:

- Vehicle identification
- Equivalent test weight
- Total vehicle inertia on the road
- Simulated inertia
- Date, time of the run
- Operator identification
- Direction of roll operation
- Mode of operation (2WD or 4WD)
- Roll designation

For the selected coastdown range:

- The upper and lower speeds of the range
- The measured elapsed time of the entire coastdown range
- Calculated frictional force coefficients a_o, b_o, and c_o using the coastdown data of the entire curve for either the dyno alone or the dyno/vehicle combination.

For each selected speed interval within the coastdown range:

- The upper and lower speeds of each interval
- The elapsed time of each coastdown interval
- Target average force for each interval
- Measured average force for each interval
- Signed difference of target average force - measured average force
- Target absorbed power for the interval
- Measured absorbed power for the interval
- Signed difference of target power absorbed - measured power absorbed
- A plot on the screen of the target and measured parameters versus the speed
  A QC analysis and out of tolerance flag if the force or power error exceeds a predefined limit.

<u>Derivation of Dynamometer Road Load Coefficients</u>

2.3.25 The dynamometer shall incorporate control logic to automatically perform sequences of vehicle coastdowns, as described above, to derive road load coefficients (“dyno set coefficients”) in

accordance with accepted industry practice, such as SAE recommended practice J2264. The control logic shall be capable of accepting track road load coefficients ("target coefficients") from an accepted industry practice such as SAE recommended practice J2263. The system shall also provide the capability to execute SAE recommended practice J2452 (stepwise coastdown tire losses).

Service/Diagnostic/Calibration Mode

2.3.26 The dynamometer system shall provide the procedures and routines to calibrate and verify periodically the essential critical parameters that control the accurate operation of the force simulation. These parameters include distance, velocity, acceleration, time, and loading force.

2.3.27 The dynamometer shall have a force measurement system to indicate the forces being applied by the dynamometer rolls to the vehicle tires. The load cell is the primary method of measuring force. This system shall be capable of indicating force readings to a resolution of 0.1% of rated output and should be capable of sampling data at a rate of 100 Hz for short durations. Calibration of the load cell or torque transducer for both positive and negative torque by the dead weight lever arm technique shall be provided as specified in section 3.0. Automatic verification of the force transducer using the known base mechanical inertia of the system and operating under dynamic constant and sequential accel/decel operation shall also be provided utilizing the function F = M*dV/dt.

The dead weight calibration data shall be logged and the complete analysis shall be reported to demonstrate the precision, accuracy and linearity of the load cell output and auxiliary voltages representing the force for both positive and negative forces. Any zero and span adjustments shall be clearly documented with respect to the raw voltages, gains, and adjusted values. An electrical shunt calibration shall be performed as part of the dead weight calibration to enable periodic checks of the load cell output stability. Any virtual zero and span adjustments that may be an option as part of the shunt calibration shall be logged and documented. Dynamometer controller software calculations can be used to minimize transducer/signal-conditioning drift. The manufacturer shall validate that the virtual span and zero calculations are operating correctly. All calibration results shall be stored for historical analysis or trend review.

2.3.28 The displacement and speed of the roller's surface shall be determined by quadrature encoders and the counting of their pulses as a function of time. The contractor shall provide a measurement and data acquisition process with the ability to check the accuracy of the encoder signal conditioning and processing functions by inputting test frequencies from a generator standard. Measured speed shall have accuracy and resolution of ±0.01 mph at all speeds. The

speed measurement shall be drift-free and shall require no analog calibration. The roll revolutions shall be used to measure the test distance driven to a resolution of at least 1 part in 2000 or ±0.05%.

The encoder shall be mounted in such a way to be free of harmonic effects and to ensure that vibration will not effect the accuracy and precision of speed measurement. If different sensors are used for speed and distance, both measurements shall be taken from the same shaft or roll.

2.3.29 Accurate electrical inertia simulation forces are a function of accurate and responsive acceleration rate determinations. The acceleration and deceleration rates (mph/sec) of the rolls shall be measured and determined by numerical methods. All acceleration rates indicated shall be accurate to within ±0.01 mph/sec and shall be determined within 30 ms of true occurrence, including accelerations from 0 mph.

2.3.30 The contractor shall provide a method for checking the wheelbase measurement instrumentation and data acquisition functions. Minimum and maximum wheelbase stops or limit switches that are permanent located can be used for this function.

2.4 Dynamometer Control Computer System (DCCS)

2.4.1 This system of computers, logic controllers, signal conditioning, displays and associated devices, as configured by the contractor shall integrate and control operation of the dynamometer and collect, process and store all data directly related to the functional requirements of the dynamometer system. The DCCS shall support both English andmetric (see definitions with Figures and Tables) units of measure. NVFEL will typically be using lbm, lbf, and mph for target and set coefficients.

2.4.2 DCCS shall provide clear, simple and logical user interfaces. The computer interface(s) shall be designed such that personnel without special computer experience will be able to operate the control system and the peripheral units, including the input of parameter changes, with minimal basic system training.

2.4.3 DCCS shall provide automation and control of tasks associated the functional requirements of Section 2.3 as well as other support functions outlined in this section. DCCS shall provide for reporting and file transfer of test data and vehicle information data, before and after the various dynamometer functions. DCCS shall perform associated quality control of calibration and test processes and provide rigorous documentation associated with quality control and traceability.

2.4.4 DCCS may consist of a range of hardware and software components depending on the configuration and functioning of the contractor's proprietary test systems, provided the automation and control requirements contained in this Statement of Work are met.

2.4.5 DCCS computer system(s) shall utilize color and real-time graphics and shall provide for a multiple window operating system. Any window on a DCCS display screen shall be printable to the test site laser printer and shall be automatically scaled to fit the page.

2.4.6 All DCCS operating system software, control software and parameters, and data acquisition interfaces shall be stored and accessed using the most up to date commercially available standard microcomputer hardware and most up to date Commercial Off the Shelf (COTS) components where possible. LCD flat-panel monitors shall be used for standard computer displays.

2.4.7 Access to all formulae and filtering algorithms and software (including dynamometer control system source code) and operation parameters shall be provided in electronic ASCII files. If this information is deemed a trade secret, it will be treated as confidential information and will be protected through a non-disclosure agreement between EPA and the contractor.

2.4.8 The road load simulation display screen shall show the target and set road load force coefficients and shall provide a graphical display of the various force versus speed or force versus elapsed time relationships. The axes of the graphs shall be logically scaled to optimum resolution and the screen shall also indicate the operating mode (2WD or 4WD) of the dynamometer, vehicle identification number, vehicle version, set-up record number, augmented braking on/off, LPVA on/off, grade simulation on/off, and an active warning message indicator, at all times. Front and rear roll set data shall be annotated in a legend and shall be shown in colors or with a plot character or line width that can differentiate the data.

2.4.9 All automated functions shall include a selectable feature to record acquired data, as configured by the user at 1, 2, 5, 10, or 20 Hz. DCCS shall also include an user selectable function to produce an appropriate separate summary report of the relevant outcomes of the function performed. A selectable function to filter or average higher Hz acquired data for tabulation or plotting shall be provided.

For all reports, pertinent header information shall be presented on each page, sufficient to uniquely identify that each page is part of the same test report. All pages, of all reports, related to specific vehicle tests shall contain the EPA test number for that test.

All report pages shall be labeled with the current page number and the total number of pages. The current date and time, in any format that contains month, day, year, hour, minute, and second, shall be contained on all printed images of screens, files, or reports from the system. The system name from which the output was generated shall also be contained on the printout.

All reports and computer records produced to document test or measurement instrument calibration/verification shall minimally contain the following information:

- Name of Operation, Pertinent references
- Date, Time, Operator
- EPA Test Site Designation
- Identification of devices and standards utilized
- All data directly related to the operation conducted
- Summarized data related to outcome such as coefficients, offsets, efficiencies, both "as found" and "as calibrated," where applicable
- Other pertinent statistics to indicate quality of outcome such as regressions statistics and other summary statistics
- Text-type notes and observations
- Pass/Fail indications and Accept or Reject indications, where applicable
- Other quality indicators and exception warnings

- Units identified for all data

2.4.10 All DCCS generated report layouts and their content shall be approved by the EPA Project Officer, as indicated in the Project Management Requirements.

2.4.11 DCCS shall also include hardware and implemented procedures for the following functions:

- Complete system backup & restore from DVD or tape
  system bootable from DVD or tape)
- System configuration, parameters backup & restore
- Test data backup & restore (to be done daily)
- File trimming based on creation date or modification date
- Complete power-down and power-up procedure sequence

2.4.12 All access to DCCS shall be password protected as follows:

Level 0 (Base Maintenance) - Routine system maintenance functions only, to include automated backup and file trimming procedures

Level 1 (Operator) - The ability to run defined tests, view active channel displays, read (but not change) test scripts, definitions, variable names and other related files, view and print reports and utilize interactive functions for analyzing data

Level 2 (Maintenance/Repair) - All level 1 plus the ability to perform diagnostics, routine maintenance and trouble shooting functions

Level 3 (Administrator/Engineering) - Full system access, all level 2 plus the ability to edit test scripts, channel configurations, bit maps, tables, user-defined variables, alarm actions, report definitions, and system configuration and other administrative functions

Other similar schemes providing equivalent, multi-level security may be acceptable.

2.4.13 DCCS shall include a selectable option, configurable at Level 3, to automatically log-out after a predefined duration of system inactivity.

<u>Interface of DCCS with other Computer Systems</u>

2.4.14 The dynamometer contractor shall provide for the interface of the DCCS system with a separate EPA supplied network interface computer (IFC). DCCS shall exchange all necessary information, including commands, data, error messages, and reports with the master/host computer system. The method and process for this exchange is outlined in Appendix C, "Interface Computer".

2.4.15 The measurement system for D329, being provided under separate contract, is required to interface with DCCS according the interface specifications found in Appendix E, "Dynamometer Data and Control Interface". The contractor providing the dynamometer system outlined in this SOW shall provide a DCCS system that also meets the requirement of these interface requirements, and shall cooperate fully with the measurement system contractor in creating a successful integration of systems.

2.4.16 The dynamometer shall operate in both a local mode, without interaction with a remote computer system, and in a slave mode, while connected to a remote system that contains vehicle test parameters and data sets, and may be used to receive or send data sets of test information or calibration as described in Appendix C, "Interface Computer". Additional interface specifications are found in Appendix D, "General Interface Guidelines".

Real-Time Data Monitoring and Recording

2.4.17 The dynamometer system shall monitor and acquire real-time data (either as analog, digital, or computed data) which shall be nominally logged at a 10 Hz frequency and saved in a file as specified by a user selectable option. Data are acquired directly from the dynamometer hardware or derived by DCCS for each roll set.

At a minimum, the DCCS shall include continuous data acquisition and recording of the following parameters:

- Road grade activation (on/off) and amplitude
- Augmented braking activation (on/off) and amplitude
- Low power vehicle adjustment activation (on/off) and amplitude
- Force applied to/from the vehicle at each roll set. A positive force vector shall represent power being absorbed from the vehicle.
- Target force
- Instantaneous force error
- Accumulated positive force error
- Accumulated negative force error

- Power absorbed from vehicle for each roll
- Power delivered to the vehicle for each roll
- Load cell force for each roll
- Speed of each roll
- Instantaneous acceleration of each roll
- Speed synchronization error (front roll - rear roll)
- Accumulated distance of each roll
- Test phase indicator (1,2,3...) Counts up by one each time DCCS receives "Phase-Reset Command" from an external source
- Acquisition rates and variables to be recorded shall be user definable. When the dynamometer is in remote mode, recording shall start and cease based on external test/reset command from an external source dynamometer is in remote mode.

Data recording shall utilize high-precision time stamping or other means of accurately aligning time critical data, such as demonstrating accurate roll speed synchronization.

2.4.18 All analog input signal converters shall have a nominal ± 10 volt range with a minimum 16 bit resolution. Analog output channels shall have a nominal ± 10 volt range with a minimum 12 bit resolution. User accessible analog signals shall be isolated and not affected by the connection of any auxiliary data acquisition systems.

2.4.19 DCCS shall provide for additional access to electronic signals as follows:

- The Dynamometer shall split each optical encoder pulse signal to two connectors that will make pulse signals available for (#1) independent speed and distance determination by a user supplied data acquisition system, and (#2) the dynamometer control system to perform its work. The pulse signals shall be a square wave 0-5 VDC. These signals shall be optically isolated so that a customer data acquisition system, connecting or disconnecting from connector #1 will not adversely affect simultaneous use of connectors #2 by the dynamometer control system.

- The Dynamometer shall split the each load cell signal to two connector that will make them available for (#1) independent force determination by a customer data acquisition system, and (#2) the dynamometer control system to perform its control. The load cell signals for the customer data acquisition system shall be ± 10 volt DC. The signals shall be optically isolated so that customer data acquisition systems, using and disconnecting from connector #1 will not adversely affect simultaneous use of connector #2 by the dynamometer control system.

- The Dynamometers shall provide two speed signal connectors per dynamometer for user data acquisition systems, or a road speed modulated cooling fan. The speed signals shall be ± 10 volt DC. Data acquisition systems using these signals will be optically isolated so that connecting, using, and disconnecting from one connector will not adversely affect other signals or simultaneous use of other connectors.

- The DCCS shall provide four analog signal channels and connectors for user selectable parameters. The signals will be monitored by customer data acquisition systems. User selectable parameters, chosen through the DCCS user interface, shall be scaled for output as appropriate. The speed signals shall be ± 10 volt DC. Data acquisition systems using these connectors shall be optically isolated so that connecting, using, and disconnecting from one connector will not adversely affect other signals simultaneous use of other connectors.

2.4.20 DCCS shall include inputs for a minimum of eight spare, ± 10 volt DC user configurable analog input channels, and two spare counters capable of 100 kHz inputs. Isolation or protection shall be provided to prevent any adverse interaction to the dynamometer system or data acquisition devices from connecting or disconnecting channels.

2.4.21 Readily accessible electrical connection points for all essential external inputs and outputs shall be provided. Connections shall be provided both through screw terminals and plugs for XLR or similar connectors. The exact connection panel location, configuration and type shall be established during the design/configuration stage of the project.

2.4.22 Error monitoring, logging and messaging, and the operating-hours counter shall function at all times.

DCCS shall include features to automatically self-check critical processor functions (e.g., CPU, memory, and input/output channels) and issue relevant warning messages or troubleshooting guidance.

2.4.23 The DCCS shall provide for automated quality control functions that are active during testing and calibration and diagnostic routines and at the completion of those processes. DCCS shall automatically check critical operating parameters to ensure that they remain within acceptable limits throughout the operation being performed.

Limits shall be stored in lookup tables, or other readily editable and modifiable files. These tables shall only be modifiable at security level 3.

Quality limit checking shall include, but not be limited to:

- Load errors
- Roll speed synchronization error
- Front and rear roll distance offsets
- Parasitic loss stability
- Abnormal zero/shunt calibration results
- Errors or abnormal results associated with calibration and diagnostic routines

2.4.24 Any report associated with an automated function shall include a summary of all appropriate quality control indicators. These shall also be retained as part of the electronic record of the function performed.

Data Storage, Retrieval and File Transfer

2.4.25 The dynamometer system shall acquire and store data for later batch transfer as a tab delimited text file or in a compatible format to a remote computer. See interface requirements in Appendix C, “Interface Computer”, and Appendix D, “General Interface Requirements”.

2.4.26 The DCCS shall store a database of test information and all relevant test parameters, including road load curve coefficients and inertia values for tested vehicles. These shall be easily accessible from the system to automate the setup of additional tests. All data sets shall have a sufficient number of characters in their nomenclature to provide unique and readily identifiable names for retrieval.

2.4.27 The dynamometer processor shall retrieve historical parasitic loss data sets from on-line disk storage or from a remote server. All dynamometer parasitic loss coefficients shall be part of the long-term data storage, and shall be readily available for trend analysis and quality control functions within the DCCS and as exported data to other analysis programs. The dynamometer rotational direction shall be part of the stored calibration data.

3.0 Calibration and Other Support Equipment

3.1.1 The contractor shall provide all necessary fixtures, adapters and weights for dead-weight calibrations of the load cells as specified in Section 5, Acceptance Testing and Review. The contractor shall provide all necessary beams, fixtures, supports, etc., that are suitable for both "positive" and "negative" dead weight loading, without removal or change in setup. These devices shall provide a means to ensure that all dead weight calibration equipment remains in proper alignment, balance, level, and plumb during the calibration process. It is highly desirable that devices shall be designed in such a way as to permit dead weight calibrations to be performed from the test cell without entry into the dynamometer pit. All fixtures and devices shall be designed in such a way as to allow safe one-person installation and removal.

3.1.2 A suitably protective, lockable, industrial-grade storage cabinet shall be provided and located near the test cell for storage of calibration weights and small parts, fixtures, adapters, etc. A means for safely storing calibration arms or other bulky devices shall also be provided.

3.1.3 Weight sets shall be certified traceable to NIST or to another international standards authority recognized as equivalent to NIST. Individual weights shall have an uncertainty of less than 0.05% of their labeled value. Individual weights shall weigh not more than 50 pounds, shall be corrosion resistant and shall be permanently stamped with a unique serial number. Any other device whose physical attributes affect the forces applied to the load cell shall also be permanently marked with a unique device number. The contractor shall also determine the equivalent net moment, if any, imposed by arms or fixtures attached to the dynamometer for dead weight calibration, in a manner traceable to NIST. All NIST traceability shall be appropriately documented per ISO DIS 17025. No physical alteration of any certified weight or device shall be made subsequent to certification.

3.1.4 Automated dead weight calibration processing routines shall provide for the input and permanent storage of weight and device serial numbers. Automated data processing quality functions for dead weight calibration shall include detection of incorrect weight identification or true mass values for all weights and fixtures/adapters or possible misalignment of equipment. The purpose of this requirement is to minimize repetitive data entry during a routine calibration and to perform real time process verification to detect operational errors or inconsistencies.

3.1.5 The contractor shall provide an independent method or auxiliary piece of equipment for verifying the accuracy and precision of the speed measurement process on each dyno and as a synchronous pair. This method shall be useable during all steady speeds and accelerations. For example, a process that acquires speed data from a frequency standard at constant or slewed rates is independent of the encoder.

3.1.6 The contractor shall provide a method or signal source that can be utilized to verify the accuracy and stability of the analog input and output channels and the A/D converter measurements. For example, a data logging process that measures speed digitally from the encoder, converts the speed to an analog output and then reads this analog out as an analog input could be used to validate the closed loop system. The data analysis and plot generation shall be automated as part of this process.

3.1.7 The contractor shall provide an independent calibration or verification process or measurement device to verify the wheelbase distance is accurate and agrees with the system readout for any adjustment.

3.1.8 One set of recommended on-hand spare parts shall be supplied, at time of installation.

4.0 Documentation Requirements

4.1.1 The contractor shall provide complete documentation for each system in this contract, including wire lists, color coding, electrical schematics, piping/tubing diagrams, operating and repair manuals, certificates of calibration and traceability and computer system documentation.

Five (5) copies of the documentation of the dynamometer system shall be provided to the Project Officer upon delivery of complete system. All documentation shall be "as installed." The documentation shall be in English and shall include, at a minimum, the following:

- Descriptions and drawings of the dynamometer mechanical layout
- Color coded (as appropriate to enhance readability) and numbered schematics of all electrical pneumatic and hydraulic components and systems
- Wiring lists for all electric systems
- Parts list(s), including a recommended, on-hand, spare parts list
- Technical and operational manual(s), including
- Complete description of the system control algorithms, response characteristics system hardware and software operation, performance measures, and system source code for all requirements
- Computer systems maintenance procedures (backup/restore system & files)
- Computer system start-up, restart and shutdown procedures
- Calibration procedures and analysis methods
- Dynamometer startup/shutdown and warm-up procedures
- Troubleshooting maintenance and calibration instructions
- Calibration and traceability certificates appropriately documented per ISO DIS 17025

4.1.2 The contractor shall also provide the documentation in computer readable user modifiable form. Microsoft Word, WordPerfect, AutoCADD, VectorWorks and Microsoft Excel are acceptable file formats as well as any that are compatible with standard translator/conversion tools provided by those applications. Supplementary files such as Powerpoint or Adobe Acrobat are acceptable or can be used to provide supporting data.

4.1.3 The operation manual(s) shall include complete well organized information on the dynamometer's functions, capabilities, calculation algorithms and user interface procedures. Operating procedures should be written clearly for use by engineers and technicians.

Operator's manuals shall provide a listing of all system warning and alarm messages, with full explanation as to their exact meaning, impact and action required.

Operator’s manuals shall provide detailed calibration, verification and preventative maintenance procedures and schedules, with a recommended spare parts inventory.

Operator’s manual shall provide a clear explanation of the data acquisition function including any signal filtering or averaging algorithms.

4.1.4 The parts list shall include, at a minimum, the following:

All subcontractors' parts, to enable the government to obtain precise information, including addresses, contacts, phone numbers, and websites.

The model and/or part number designations of all major component parts or assemblies. Any part that requires extended delivery or special acquisition. Suppliers for items requiring maintenance or replacement such as AC motor, bearings, or power converter components are preferred to have inventories maintained in the U. S.

5.0 Acceptance Testing and Review Requirements

5.1 General Provisions

5.1.1 The contractor shall develop a comprehensive final acceptance plan, to be approved by EPA, which will verify that all requirements contained in this Statement of Work, and referenced documents, have been achieved in the delivered system(s). This verification shall take place, to the greatest extent possible, at the contractor's point of final assembly prior to delivery of the system to EPA. Acceptance evaluations shall be conducted on each dynamometer operating independently (FWD, RWD) and also when the machines are operating in the 4WD mode. Total load accuracy and roll synchronization, and restraint system integrity shall be the key parameters to verify in the 4WD mode.

5.1.2 The contractor shall deliver the complete acceptance plan, for approval by EPA at least 60 days prior to the start of the acceptance process. Prior to commencement of acceptance testing, the EPA Project Officer must approve the acceptance plan, in writing. Once approved, the contractor shall provide the EPA Project Officer with a detailed schedule of acceptance activities at least 25 days in advance.

EPA personnel shall observe the acceptance process. However, the EPA Project Officer may waive the opportunity to observe certain aspects of the acceptance process. At least 10 days in advance of the acceptance process, the Project Officer will indicate which activities EPA personnel will observe.

5.1.3 The acceptance shall be based on demonstrated performance, including actual vehicle testing. The contractor shall perform the acceptance process on the delivered systems after installation at NVFEL, to the extent necessary, to verify full compliance with the requirements in the final installation. The plan shall consider all aspects of system variability, so that all test results demonstrate compliance with a high level of statistical confidence. A summary of the principal functions, specifications, and acceptance criteria are shown in Table A. The acceptance plan shall describe in detail how compliance with SOW criteria will be demonstrated.

5.1.4 All acceptance testing shall be the responsibility of the contractor. The contractor, at the contractor's expense shall rectify all non-compliant conditions. If repairs or changes are made, the contractor shall repeat acceptance testing to demonstrate the acceptable quality of the final product, to the extent necessitated by the scope of the repair or change. The contractor shall prepare a report for each phase of acceptance testing that describes all the various tests and reviews conducted as part of the acceptance activity, the outcomes of those tests and a description of follow up actions, as required.

5.1.5 Reserved.

5.1.6 The acceptance plan shall be cross-referenced, section by section in a straightforward manner, to the requirements of this Statement of Work. The plan shall be designed in such a manner as to also form the basis of a final acceptance report. The acceptance plan shall also address all other requirements deemed significant and appropriate by the contractor, based on the specific design and configuration of their system and significant proprietary features. Certain specific tests to be performed as part of the acceptance process are outlined in this Statement of Work. The contractor may propose alternatives, subject to EPA approval.

5.1.7 Upon completion of any off-site testing, the contractor shall deliver a preliminary acceptance report to EPA within 15 days. EPA shall complete all reviews within 15 days of receipt of the report. No authorization to ship the dynamometer shall be made until acceptance of the dynamometer's performance is approved by the EPA Project Officer. The contractor shall accept full responsibility for any equipment, supplies, or materials shipped prior to Government approval.

5.1.8 The acceptance report shall provide documented evidence of compliance to the requirements of this Statement of Work and the Acceptance Plan, with content and format suitable for successful audit to ISO DIS 17025 standards. Additional report requirements are presented below.

5.1.9 Acceptance activities shall include an evaluation of the potential for aliasing or other inadvertent system effects on precision and accuracy.

5.1.10 The contractor shall submit, for EPA review and approval, the force, speed, and acceleration calibration procedures as well as the proposed electrical and base mechanical inertia simulation verification procedure 15 days before the performance and submission of results from calibrations. The contractor shall supply complete procedures for performing parasitic loss corrections for EPA review before beginning any testing.

5.1.11 The contractor shall submit a report to the EPA Project Officer within 30 days of completion of acceptance testing. The report shall contain, at a minimum:

- A complete description of all parameters related to the tests
- Test dates
- Personnel involved
- Location (test site and dynamometer serial number)
- Ambient conditions (including time of day, barometer, temperature, and humidity)

- Axle loads
- Vehicle curb weight
- All setup parameters used in the configuration of the subject dynamometer to perform the acceptance tests.
- A complete list of all external test and signal conditioning equipment, including make, model number, resolution, and measurement rates for each parameter.

5.1.12 Analysis and Presentation

All testing results shall be supplied with summary tables containing the following, as applicable, at a minimum:

- Elapsed time (seconds; xxxx.xx)
- Driver's trace and vehicle speed (mph; xx.xx)
- Front dyno encoder readings (sample period Hz and total counts)
- Front dyno velocities and accelerations (mph, mph/sec ; xx.xx)
- Rear dyno encoder reading (sample period Hz and total counts)
- Rear dyno velocities and accelerations (mph, mph/sec; xx.xx)
- Front dyno power absorption unit tractive force (lbf; xxxx.x)
- Front dyno power absorption unit horsepower (hp; xxx.xx)
- Front dyno power absorption unit amperage (amps; xxx.x)
- Rear dyno power absorption unit tractive force (lbf; xxxx.x)
- Rear dyno power absorption unit horsepower (hp; xxx.xx)
- Rear dyno power absorption unit amperage (amps; xxx.xx)
- Roll speed synchronization error (mph; xx.xx)
- Target total force (lbf; xxxx.x)
- Total force error (lbf; xx.x)

All dynamometer settings to document loaded (vehicle on dynamometer) and unloaded (no vehicle on dynamometer) tests.

Other information and data sets, as necessary to document achievement of requirements.

5.1.13 The specified data for all tests shall be supplied in tab delimited ASCII text files as a function of sample collection time, sampled at least 20 times per second. The data may be recorded in SI or English units and converted to the units specified above providing the resolution and format of the raw data complies with the required specifications.

5.1.14 The subsequent portions of Section 5 present nominal requirements for certain critical aspects of the acceptance activity. The contractor may propose alternate methods, subject to EPA approval. EPA approval may be granted if the contractor can provide engineering justification that the alternate approach is at least as stringent as those presented in this SOW.

5.2 Component Review

The contractor shall review and verify the basic mechanical, electrical and operational features meet the requirements of this Statement of Work. This review shall include, but not be limited to the following elements.

5.2.1 The contractor shall conduct dimensional measurements and review of the dynamometer to verify assembly of the dynamometer to requirements. The contractor measurements shall include roll diameter, roller set parallelism, roll spacing, and surface finish. A dimensional and mechanical analysis of the base mechanical inertia shall be provided. This review shall also include a review of installation details for conformance to specific site installation conditions.

5.2.2 The contractor shall demonstrate that deflection of the dynamometer frame and other structural components shall not adversely affect dynamometer performance or operation under the most severe operating conditions. Front and rear roll parallelism and alignment shall not change over the range of test vehicles and loads the dynamometer is capable of accommodating. The contractor shall submit engineering data and/or analysis to document compliance with this requirement.

5.2.3 The contractor shall verify the wheelbase adjustment speed, accuracy, and repeatability.

5.2.4 The contractor shall verify that all other basic components and features are in keeping with the Statement of Work and approved plans, designs and configurations.

5.3 Calibration and Review of Measurement System Accuracy

5.3.1 The contractor shall utilize NIST traceable materials or equipment in performing calibrations of the various dynamometer measurement systems. All exceptions to this requirement must be approved by EPA in advance. The contractor shall verify the precision and accuracy of those calibrated systems. This activity shall include, but not be limited to the following elements.

5.3.2 The contractor shall use the "dead weight" technique to calibrate the dynamometer load cells and verify load cell accuracy and linearity at multiple points. The contractor shall provide all measurement data related to this calibration and verification, including documentation of the effective fixture arm length, weight, balance, and alignment.

The verification of dead weight calibration shall have uniformly spaced verification points from maximum to minimum. The verification of the load cell calibration shall demonstrate accuracy to within ± 0.1% of full scale (FS) for each calibration point from -100 to +100 percent of the torque transducer FS.

5.3.3 The calibration weights and torque fixture provided with the dynamometers shall be utilized for this evaluation. On both positive and negative torque verifications, weights shall be applied both sequentially and in random order as shown in the table below. The table expresses weight in nominal percent of full scale. The contractor shall supply data to substantiate that the dynamometer load measuring system satisfies the following requirements:

Load Cell Calibration Sequences and Values

Positive = Vehicle Accels		**Negative = Vehicle Decels**		**Random**	
Load	Unload	Load	Unload	Load	Unload
zero/shunt	100%	zero/shunt	-100%	20%	-40%
10%	90%	-10%	-90%	80%	-10%
20%	80%	-20%	-80%	30%	-20%
30%	70%	-30%	-70%	zero/shunt	zero/shunt
40%	60%	-40%	-60%	-80%	50%
50%	50%	-50%	-50%	-30%	40%
60%	40%	-60%	-40%	-100%	100%
70%	30%	-70%	-30%	zero/shunt	zero/shunt
80%	20%	-80%	-20%	10%	-30%
90%	10%	-90%	-10%	90%	-80%
100%	zero/shunt	-100%	zero/shunt	60%	-90%

Positive is equivalent to power absorbed from a tire.

Negative is equivalent to power delivered to a tire.

5.3.4 The acceptance report shall include a linear regression analysis of this load cell weight versus voltage (raw and any corrected values based on shunt data) and converted load values to demonstrate the following:

- Hysteresis (Load -Unload pairs) within ± 0.1% of full scale
- Repeatability (five repeat applications) within ± 0.05% of full scale
- Non-Linearity (deviation at midscale) within ± 0.1% of full scale
- Zero and Shunt Drift (Second- Previous) within ± 0.1% over 24 hours

Torque Transducer Virtual Span & Zero

5.3.5 Dynamometer controller software calculations may be used to minimize torque transducer/signal conditioning drift. The following equations describe this software technique. Other methods may be described or proposed if shown to produce comparable results. If the contractor utilizes any of these techniques, test data shall be provided to verify the accurate performance.

$$Vc = Vm(G) + B$$

where:

Vc = Corrected Output
Vm = Measured Output
G = (Sref – Zref) / (Sact – Zact)
B = (Sref * Zref) / (Sact – Zact)

and

Sref = The expected shunt resistor reading determined during transducer calibration (this is typically targeted at 75-80% FS)
Sact = The actual shunt reading
Zref = The expected transducer output with 0 torque
Zact = The actual zero reading

5.3.6 The roll speed measurement accuracy shall be demonstrated and independently verified to be accurate to within ± 0.05 mph. Speed shall be determined at least every 10 milliseconds.

5.3.7 Measurement or determination of angular acceleration shall be demonstrated and verified to be accurate to ± 0.01 mph/sec or ±0.5% of value, which ever is greater.

5.3.8 Time measurement shall be demonstrated and verified to be accurate to within 0.01 seconds, while totalizing 1000 seconds.

5.4 Electrical Inertia Simulation Response Test

5.4.1 Simulation response shall be evaluated by measuring the dynamometer force response to an acceleration/deceleration ramp reversal comparable to the "timing test" currently utilized on our single roll dynamometers. The response definitions are contained and illustrated in Figure 5. The inertia setting shall be base mechanical inertia. The rolls shall be accelerated and decelerated at 8 mph/sec and 0.5 mph/sec in sawtooth profiles.

5.4.2 Response time in all cases shall be less than 100 milliseconds to reach a critically dampened response to within ±10% of final value. Overshoot and settling time shall also be evaluated and quantified. Plots of collected data shall be made.

5.5 Determination and Verification of the Dynamometer Parasitic Forces

The purpose of this activity is to ensure the accuracy and stability of the dynamometer parasitic loss determination. The contractor shall utilize their recommended procedures to determine the parasitic forces present in the dynamometer rolls and shall evaluate the stability and accuracy of these forces by a secondary means.

5.5.1 Once the dynamometer has been warmed according to the contractor's published procedure, motoring torque versus elapsed time data shall be recorded. Parasitic loss force shall be stable to within ± 1.0 lbf, or 0.1 hp after ten minutes at an average speed of 50 mph, when the dynamometer is started after a two-hour idle period exposed to an ambient temperature of 68-86 °F.

5.5.2 Once the dynamometer has achieved stable parasitic loss, the contractor shall perform coastdowns without a vehicle from 85 to 5 mph, with dynamometer controller set to maintain zero load at the load cell, and calculate parasitic losses (lbs. force). A constant load may also be controlled and subtracted to shorten the coastdown period as necessary. The contractor shall demonstrate that the dynamometer will accept a target vehicle road load curve and calculate the required coefficients necessary to match the vehicle load curve with compensation for the previously calculated parasitic losses.

5.5.3 An assessment of the parasitic friction behavior following a period of non operation shall be performed. The dynamometer shall be allowed to sit for a minimum of two hours. The dynamometer shall then motor itself through a series of steady speeds, each 30-seconds in duration, at 10, 20, 30, 40, 50, 60, 70, and 80 mph, followed by a zero load cell coastdown from 85 to 5 mph at the base inertia setting. This steady state/coastdown sequence shall be repeated within one hour.

NOTE: If the coastdown exceeds five minutes with no electrical load, a constant electrical force may be applied to limit the coastdown to less than five minutes.

The data generated shall be analyzed to verify all coastdown calculation capabilities and that the parasitic losses remain stable within ± 1 pound from the base values at each speed point.

5.5.4 The contractor shall also provide documentation that the recommended parasitic calibration frequency will eliminate parasitic loss changes greater than 0.1 hp at 50 mph (1 lb) for dynamometer environment temperatures between 50 and 100 °F.

5.6 Determination and Verification of the Mechanical Inertia of the Rolls

The purpose of this activity is to assure the accuracy of the base inertia determination of the dynamometer, since this value is critical to the accuracy and correct operation of the dynamometer.

5.6.1 The contractor shall supply a complete summary of all rotating physical components of the dynamometer and their individual contribution to total calculated mechanical inertia. The description shall include diagrams of physical layout and specific definition of which components are inside or outside the dynamometer's control loop.

5.6.2 The contractor shall provide verification of physical measurements to document that components that contribute to the mechanical inertia of the dynamometer have been built to specification.

5.6.3 The total system inertia shall be verified through dynamic tests using the dynamometer system. For this function, the dynamometer shall be programmed to operate at its base mechanical inertia weight and zero road load. From a steady lower speed (about 15 mph) and using a constant acceleration rate, the dynamometer shall accelerate to a speed that is about 20 mph higher and then decelerate at the same rate back to below the lower speed. The collected force data going up and down shall be averaged to compensate for parasitic forces and then used to verify the mechanical base inertia by the following equation:

Force = (W/g)a

where:

F	=	Force applied at the load cell to accel/decel the roll
W	=	Base inertia (lbm)
g	=	Gravitational constant (32.174 (ft)(lbm)/(lbf)(sec^2)
a	=	Acceleration /Deceleration rate of the roll in ft/sec^2

Combining with g and converting acceleration units to mph/sec produces the calculated inertia:

$W_{calculated}$ = F / (0.045585 * (dV/dt))

where:

0.045585 = 5280 / (3600 * 32.174)

$W_{calculated}$	=	Calculated mechanical inertia (lbm.)
F	=	average applied force ,measured by dynamometer (lbf.) over the sample interval, where the sample interval is one acceleration and one deceleration
(dV/dt)	=	Measured interval average acceleration (mph/sec)

5.6.4 The accel/decel procedure shall be repeated five times at configurable and nominal rates of 0.5, 1, 3, 6, and 8 mph/second as well as at a rate that utilizes the maximum rated dynamometer motoring horsepower. All required data shall be logged to a file at 20 Hz.

5.6.5 The average value of Wcalc'd at each accel and decel rate shall be within ± 0.2% of the contractor's specified base inertia weight. The cause of any deviations shall be determined and documented in the acceptance report and rectified. Testing shall be repeated, if necessary to establish compliance with the requirement.

5.7 Verification of Friction Compensation

5.7.1 Friction compensation accuracy shall be checked with a warmed dynamometer and all road-load simulation coefficients ($F = A + BV + CV^2$) set to zero for each of three separate inertia weight settings (Base Inertia Weight, 1000 lbs., and 14000 lbs.).

After motoring to 50 mph, the dynamometer shall be switched to road simulation mode and shall compensate for all parasitic losses. Ideally, the speed of the roll should not change if parasitic losses are perfectly compensated. Speed drift (see Table A) versus time shall be used to determine the compensation error.

f_{error} = compensation error (lbs) = m (dV) (0.045585) / dt

where:

m = actual inertia
dV = speed drift (mph)
dt = time over speed change (sec)

In addition, the friction compensation accuracy shall be recorded at steady speeds of 10, 20, 30, 40, and 60, 70, and 80 mph for each of the above inertia settings.

The compensation error at each speed shall not exceed ± 1 lb at any steady state speed.

5.8 Road-Load Curve Simulation Accuracy and Repeatability

5.8.1 Accuracy and repeatability of the road load curve function shall be determined from five separate 85 to 5 mph continuous coastdown tests (without a vehicle) at each load setting from below. Coastdown force shall be determined at speeds of 80, 70, 60, 50, 40, 30, 20, and 10 mph. The value of coefficient A may be changed as needed to limit the total coast down duration to less than 5 minutes. The error (e_i) at each coastdown point is the difference between the calculated force and the measured coastdown force:

$$e_i = F_{calc} - F_m$$

$$F_{calc} = A + B * V + C * V^2$$

$$F_m = (0.045585)\ (IW)\ (dV/dt)$$

where:

dV/dt = Measured (dV and dt) and calculated sample interval acceleration (20 samples/sec sampling rate). DV/dt shall be the value at the midpoint speed of the interval and not the average between the end points of the interval.

IW = Inertia weight setting (lbs)

Measurements shall be made at the following three road-load horsepower and inertia conditions:

DYNAMOMETER BASE INERTIA
A = 20.0 lbs, B = C =0, and I = Dynamometer Base Inertia
If ABC were all zero, this is the speed drift test discussed earlier.

Low Inertia Setting
A = -26.2 lbs, B = C = 0, and I = 1,000 lb

High Inertia Setting
A = 187.5 lbs, B = C = 0, and I = 14,000 lb

5.8.2 Accuracy shall be defined as the average force error. Repeatability shall be defined as two

times the standard deviation, for each speed point.

5.8.3 Coastdown accuracy and repeatability versus speed shall be documented for the minimum and maximum IW and force curve settings and shall not be significantly different, at a 90% statistical confidence level, from the dynamometer's accuracy and repeatability at its base mechanical inertia weight setting.

5.9 Restraint System Test

5.9.1 A medium duty vehicle shall be properly positioned and normally restrained on the dynamometer to demonstrate the acceptability of the set-up time. The dynamometer shall be in 4WD mode.

5.9.2 Suitable instrumentation for determining horizontal movement of the vehicle fore and aft shall be set in place.

5.9.3 The vehicle shall then be operated at wide open throttle for approximately five seconds, then the vehicle brakes shall be applied forcefully (almost locked brakes after confidence is gained) for approximately one second (until the driver's trace speed decreases discernibly). Basically, this test is to apply abrupt forces of significant magnitude to the machines.

This sequence shall be repeated five times and all data collected shall be analyzed to demonstrate the integrity of the restraints. The horizontal displacement of the vehicle frame and body in any direction shall remain less than ±1.0 inches.

5.10 Steady State Speed Loading Test

5.10.1 This shall be performed with a vehicle operating in RWD, FWD, and 4WD mode. The drive tires shall be placed on the appropriate dyno for loading.

5.10.2 The stabilized dynamometer shall be programmed with two loading curves as illustrated in the Figure 3. The contractor shall perform steady state tests ranging from 10 to 80 mph in nominal 10 mph increments. Each shall be of 30 seconds duration, (ascending or descending order) for each dynamometer load set curve. All data shall be logged for the last 10 seconds of each speed point. Five replicates of each run shall be recorded. The driver's trace speed signals shall remain within ± 0.1 mph during the data recording periods.

5.10.3 The dynamometer force data from each steady state/speed shall be graphed versus speed (mph). The dynamometer force data from five runs shall be within ± 1 % of a curve of the mean values (from 10 to 80 mph) for the five replicate runs. The mean values for each speed increment shall be calculated by the formula in the example at the end of this section. The data shall be graphed in a manner similar to that shown in Figure 4.

5.11 Fixed Acceleration Rate Test

5.11.1 This shall be performed with a vehicle operating in RWD, FWD, and 4WD mode. The drive tires shall be placed on the appropriate dyno for loading. The vehicle shall be used to accelerate the dynamometer. The road load curves shall be set as shown in Figure 3 or some similar appropriate load set that reflects the vehicle.

5.11.2 The tests shall be performed at 1000 (2000 in 4WD) and 8500 (14000 in 4WD) pound inertia weight settings. The contractor shall perform acceleration test sequences for nominal 2, 6, and 8 mph/sec accelerations from 0 to 80 mph at the lower inertia and 1, 3, and 5 mph/sec from 0 to 80 mph at the high inertia. The sequences shall consist of one run per acceleration rate and inertia setting (six runs per mode of operation).

The dynamometer tractive force from each acceleration shall be graphed versus the dynamometer acceleration rate (dV/dt). All dynamometer tractive force data shall be within ± 2 % of a curve of the target force values versus acceleration rate.

5.11.3 Each target force value shall be calculated by the following formula:

Fcalc = Mset (0.045585)(dV/dt)
where:
Fcalc = Calculated instantaneous force (lbs.)
Mset = Set inertia (lbm.)
dV/dt = Measured (or calculated) sample interval acceleration (at 20 samples/sec sampling rate)

See Figure 4 for an example of how the data shall be graphed.
Other analysis and displays may be used.

5.12 Vehicle Coastdown Neutral Rolling Load Test

5.12.1 This shall be performed with a vehicle operating in RWD, FWD, and 4WD mode. The drive tires shall be placed on the appropriate dyno for loading. The vehicle shall be used to accelerate the dynamometer. The road load curve shall be set similar to that shown in Figure 3.

5.12.2 The contractor shall perform neutral coastdown tests from 85 to 5 mph consisting of five replicate runs per inertia weight using the load curves and inertia weights (1000 and 14,000) specified in the Figure 3 as done above. The difference of actual power absorbed and dyno power absorbed shall be calculated at each 10 mph speed interval to determine the vehicle drivetrain and tire/roll loss force equivalent. Refer to SAE J2452 procedure.

The dynamometer force data and vehicle tire/roll loss force data shall be graphed versus dynamometer speed. The dynamometer force data shall be within ± 2 % of a curve of the mean values (from 80 to 10 mph) for the five runs. The data shall be graphed in the same manner as in Figures 3 and 4.

5.13 Urban Dynamometer Driving Schedule Test (UDDS-Hot 505 seconds, US06)

5.13.1 These tests shall be performed with a vehicle operating in RWD, FWD, and 4WD mode. The drive tires shall be placed on the appropriate dyno for loading. The road load curve shall be set as shown in Figure 3.

5.13.2 The testing shall be conducted on a dynamometer with a vehicle using load curves and a test inertia weight specified by EPA. A minimum of five sequential UDDS - 505 tests and five US06 tests shall be run for each test specified.

The data required under 5.1.11 and 5.1.12 shall be logged at a sample rate of 20 Hz and stored in a disk file by the system computer for the first 505 seconds of the UDDS and for the entire US06.

5.13.3 The dynamometer controller software shall perform the following analysis of the force error and speed synchronization profiles. Statistics on the values of the force error versus reference force and velocity shall be generated, along with statistics on speed sychronization error, and roll distance traveled error. The dynamometer software shall report the minimum, maximum, average, standard deviation, and number of values collected for each error measure for each ten mph speed interval during the test phase.

5.13.4 System performance verified through the analysis of the force error signal shall utilize the equation for the force error signal is as follows:

$$Em = 100 * (Fm - Fr)/ Fr$$

where:
Em = Force Error Signal
Fm = Measured Force
Fr = Reference Force

Measurements shall be made during each vehicle test sequence performed in this section to demonstrate achievement of accurate loading and speed synchronization.

The average force error signal over the UDDS - 505 seconds shall be within ± 1% over the entire speed range.

Front and rear roll speeds shall be synchronous within ± 0.1 mph. This translates to synchronous 48" roll displacements that remain within ± 0.2 "/sec, or ± 0.5 degrees/sec, under

all 4WD operating conditions. Achievement of this requirement shall be assessed by analyzing the running 1 second average of each roll speed acquired at 20 Hz as measured by either the dynamometer roll speed sensors, or by an external high speed data acquisition device.

For any test condition total front roll distance shall not differ by more than 0.02% of the total rear roll distance.

5.13.5 The collected data shall be supplied to EPA for review and evaluation. EPA may perform further statistical analysis of the replicate to quantify the performance characteristics of the dynamometer/vehicle system operating under transient driving schedules.

5.14 E-Stop and Safety Testing

5.14.1 The dynamometer shall be fully warmed and then operated for at least 30 minutes at a series of various speeds and force conditions that produce maximum plus/minus torque. The dynamometer, set at its base inertia weight, shall motor itself from 0 to 60 mph at the maximum motor hp. The emergency stop shall be activated to decelerate the dynamometer to zero mph. This sequence shall be repeated five times within 30 minutes.

5.14.2 A change of wheelbase shall be attempted while the dyno rolls are turning in 4WD mode to confirm the lockout function is operational. An attempt to turn the dyno rolls shall be made while a wheelbase change is in progress.

6.0 Warranty

6.0.1 The contractor shall warranty the dynamometer, and all other equipment and software delivered as part of this contract, for a period of one year from the date of final EPA acceptance. During this period, the contractor shall repair or replace at their cost any portion of the delivered dynamometer system that fails to perform in accordance with this Statement of Work. During this period the contractor shall also provide at least one preventative maintenance visit at no additional charge.

6.0.2 The contractor shall provide for an extended warranty and preventative maintenance contract that can be renewed annually for up to 2 additional years.

7.0 Training

7.0.1 The contractor shall provide up to 32 hours of training in the operation and maintenance of the dynamometer system for up to 12 EPA personnel. No more than 6 individuals shall be trained at one time in order to provide an effective learning experience.

8.0 Optional Items

Options: Maintenance
Remedial, Preventative, and Replacement Parts for the Second through Fifth years after acceptance of the system (First year shall be covered by warranty).
Remedial Maintenance: shall be performed after a service call is placed indicating that system is inoperative or operating with diminished capability. The contractor shall have a technician on the job within 24 hours of being notified by the Project Officer. All work shall be performed during normal working hours.

Preventative Maintenance: periodic maintenance designed to keep the system in operating condition. Preventative Maintenance shall be performed once per period (minimum) or in accordance with standard commercial practices. The performance date is to be determined by the contractor. Preventative Maintenance shall include inspection and testing of equipment. Contractor shall clean, adjust and lubricate equipment according to manufacturer's recommendations guidelines.

8.1 Service Tickets
The contractor shall submit to the designated Project Officer upon completion of service work (Remedial or Preventative) a legible service ticket containing the following information:

1. Date of service
2. Equipment type, model number, and serial number
3. Brief narrative description of work performed
4. Copy of preventative maintenance inspection report
5. Listing of any parts used, with manufacturer's part numbers, identified as new or exchange items
6. Signature of service person
7. Labor and replacement parts to be itemized
8. Signature of Project Officer accepting work. After normal business hours, signature may be obtained from responsible person in department concerned, or Agency Police.

A copy of this service ticket must be attached to invoices submitted for payment. Payment will not be made if service ticket is missing.

8.3 Coordination of Work
Contractor shall coordinate a work schedule for preventative maintenance with the designated Project Officer within 30 days of exercise of option.

8.4 Safety Requirements
Contractor shall take all safety precautions, such as lock out/ tag out procedures and confined space

procedures, to protect the health and lives of occupants of the building. Contracting Officer shall notify the Contractor of any noncompliance with the foregoing provisions and the action required to correct the conditions. If contractor, or his representative, fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or any part of the work.

8.5 Security Requirements

Contractor employees working under this contract who will perform work on-site shall be subject to security screening requirements. Contractor is responsible for performing the background checks and for screening unacceptable candidates from the pool of on-site workers. Contractor is required to maintain records of background checks and to make them available for government review upon demand. Contractor is responsible for completing a background check on each of its employees prior to the employee beginning on-site work. Background checks on current employees meeting the criteria established below are considered valid. To be valid for employees for whom background checks have not taken place, a background check must be performed within 60 days of exercise of option. At a minimum , the background check will include:

1. National Criminal and Civil Records (to include a Social Security Number trace)
2. Verification of US Citizenship or Legal Resident Status
3. Written inquiries to appropriate local law enforcement agencies, former employers and supervisors, references, and schools attended by the person under investigation
4. Professional license and certification verification

EPA may designate certain contractor employees who will be subject to higher levels of scrutiny. In those instances the employee and the parameters of the investigation will be specified.

Whenever a contractor becomes aware that the retention of an employee for work at an on-site location under this contract is inconsistent with the interests of national security, such information shall be immediately provided to the Contracting Officer, and the employee shall be immediately removed from the site and replaced with a qualified substitute.

8.6 Payment for Optional Maintenance

Payment will be made **MONTHLY IN ARREARS** upon submission of a properly prepared invoice for the contractor. Contract number assigned to this contract must appear on all invoices. As previously set forth, a copy of this service ticket must be attached to invoices submitted for payment. Payment will not be made if service ticket is missing.

8.7 Exercise of Options

If an option is not exercised for either Remedial or Preventative Maintenance in a certain period, then that option is no longer available for exercise in future years. For example, if the Preventative Maintenance Option is not exercised in Option Period 2, then that Option is NOT AVAILABLE in

Option Period 3.

Figures

All Figures are contained in the Acrobat.pdf file

Table A

Functional Specifications and Performance Criteria for MDV 4WD Dynamometer for NVFEL

This table is presented as an overview of the major requirements of the dynamometer. Please refer to the Statement of Work for exact requirements and details.

Item Description	Specification	Criteria	Acceptance
Component Review			
Roll Diameter	48.000"	± 0.010"	Verify
Diameter Differences per set	± 0.010"	Per roll set	Documented
Roll Surface Roughness	Tractive Effort Note	150-250 micro-inches	GAR Comparator
Roll Surface Hardness	Minimum	Rockwell B90	Measure
Roll Surface Protection	Suitable Treatment	No Corrosion/Rust	Verify
Roll Set Dynamic Balance	Quality Standard I	SO G-6.3 or better	Documented
Roll Concentricity	Total Indicated Runout	0.010"	Measure/Verify
Base Mechanical IW	Complete Roll Set Assembly	± 0.2% of calculated	Document and Test
4WD Roll Set Parallelism	At Min and Max WBase	± 0.25" at CntrLine Diff	Measure/Verify
4WD Roll Elevations	TDC at min/max WB	± 0.5" per 100"	Measure wrt floor
Track Width Range	Min and Max	36" min, 100-108" max	Measure
Wheelbase Range	86" - 230"	Within xxx.x " 0.2"	Measure
Wheelbase Change	Alarm and Lockout	Audible/Visual	Exists and operational
Wheelbase Change Duration	Min to Max	Less than 5 minutes	Measure
Deck Frame Structure	Minimal Deflections	10,000 lb axle loads	Test
Deck Plate Provisions	Skid resistant	Colors and attachments	Each less than 200 lbs
Cal Weights, Fixture, Cabinet	NIST certified, S/N stamp	0.05%, 50 lbs individual	Document and Verify
Safety, Quality Control, Security			
Roll Covers/Wheel Barriers	Personnel Protection	Color and time to install	Verify Operation
Tire Dyno Noise Levels	Sound dampening	Less than 75db at 10 feet	Measure
E-Stop buttons	Control, Cell, Pendant, Pit	Labels and Alarms	Test
Vehicle Body/Frame Restraint	T-Slots plus 4WD	Less than 1" Fore/Aft/L/R	Measure under max load
Safety Alarms, Signs	As Applicable	Functional	Verify
Veh Restraint Installation	Single Operator	Install 12 min, Remove 3 min	Test
Axle Centering and Brake	Driver activated	Non contact brake released	Test
Security and Data Backups	4 levels	Tape, CD, or DVD	Test and Verify
Auxiliary Data Input Channels	8 analog, 2 counters	± 10 VDC, 100 KHz	Test and Verify
Functionality and Control			
Time Base Accuracy/Res	10 ms data cycle	± 0.01 secs in 1000.xxx secs	Verify
Speed Measure Accuracy	Quadrature Digital Encoder	± 0.01 mph xx.xx	Verify
Accel/Decel Rates (0-10 mph/sec)	Resolution/Response	± 0.01 mph/sec or ± 0.5% value	Test and Verify
Torque Transducer Specs	Linearity, Repeat, Hyst, Drift	.1%, .05%, .1%, .1% in 24hrs	Vendor data and Test
Load Cell Shunt Test	Correlate to Dead Wt.	75-100% and Precise	Test and Verify
Shunt Cal Virtual Zero/Span	Adjustment for drift	Calcs for G and B	Verify data and values

Load Display Capability	Roll Speed xx.xx mph	Pendant, Control Room	Verify
	Tractive Force xxxx.x lbs	Pendant, Control Room	Verify
	Tractive Hp xxx.x Hp	Pendant, Control Room	Verify
Wheelbase Adjust	Indicate Final Wbase xxx.x	Set, Alarm, Store	Verify
Modes of Operation	FWD, RWD, 4WD	Indicated and stored	Verify in file
Total RL Sim Accuracy	Under all conditions	Lesser of 2.0 lbs or ± 1% of RL	Test
Dyno Self-Motor Cycle	Follow 1 Hz V vs t Trace	ASCII File input	Test and Verify
Dyno Parasitics/Roll	Determined and Stored	Date Time Stamp	Verify
Parasitic Warmup/Stability	Steady 50 mph for 10 minutes	Stable within ± 0.1 Hp, ± 1 lb	Test and Verify
Dyno Rotational Direction	Bidirectional Capable	Stored in file	Verify
Base Mechanical Accel Rate	0 to 10 mph/sec	0-100 mph	Measure maximum rate
Dyno Coastdowns	With and w/o vehicle	Parasitic values	Compare values
Dynamic IW Measurement	Acell/Decel tests	Base Mechanical	Test at 4 accel/decel rates

Table A

Functional Specifications and Performance Criteria for MDV 4WD Dynamometer for NVFEL

This table is presented as an overview of the major requirements of the dynamometer.
Please refer to the Statement of Work for exact requirements and details.

Item Description	Specification	Criteria	Acceptance
Functionality and Control (Continued)			
Inertia Simulation Range	Total Force Capacity	1000-14000 lbm	Verify per roll set
Vehicle Wheel Torq/Spd	Auxiliary Inputs Provided	0-10 VDC, 100KHz	Verify and Test
Load Cell Calibration	± Seq and Random	± 0.1% of FS	Verify Calibration Report
Torq Cal Shunt Test	Part of Dead Wt. Cal.	80-100% FS	Test and Verify stored
Low Power Vehicle Adjust	0-10 VDC input	Adjust load 0-100%	Test and Verify
E-Stop Test	Control, Cell, Pendant, Pit	Decel Safely to Zero	Test and Verify
Force Response to Step Demand	Test three step demands	100 ms to 90% of final	Test response rate
Critically Damped Response	Power control tuning	Stable to 3% in 150 ms	Test overshoot/ final
Speed Drift ABC=0 Test	Stability of Parasitics	± 0.1mph for 120 secs	Verify PLoss Comp
User Signal Outputs	V, F, Accel, t, F @Roll	Not affected by DAQs	Test, record, analyze
Performance in FWD and RWD Modes - (Single Dynamometer Operation)			
Data Displays	Speed, Force, Hp	Per Active Roll Set	Record and Verify
Data Logging (DCCS Real-Time)	All values specified	Per Active Roll Set	Record and Verify
Data Logging Rates	User Selectable	1, 5, 10, 20 Hz TD ASCII	Record and Verify
Response to Step Change	Total RL and Speed	Per SOW	Test and Verify
Distance per Roll Revs	Distance	xxx.xxx miles ± 0.05 %	Test and Verify

Total Road Load Control	Achieve Target Loading	± 2 lbs or 1% of value	Record and Verify
Integrated Error	Commutative Summary	Min, Max, RMS	Test and Verify
Integrated Energy Transfer "	Commutative Summaries	Min, Max, RMS for " Hp	Test and Verify

Performance in 4WD Mode - (Using Any Configuration of Vehicle)

Data Displays	Speed, Force, Hp	Each Roll and Total	Record and Verify
Data Logging (DCCS Real-Time)	All values specified	Each Roll and Total	Record and Verify
Data Logging Rates	User Selectable	1, 5, 10, 20Hz TD ASCII	Record and Verify
4WD Synchronization	All test conditions	± 0.1mph	Test and Verify
Response to Step Change	Total RL and Speed	Per SOW	Test and Verify
Displacement Sync at Roll	Virtual Coupling	± 0.2"/second	Test and Verify
Distance per Roll Revs	Distance Differences	± 0.02% over FTP	Test and Verify
Total Road Load Control	Achieve Target Loading	± 2 lbs or 1% of value	Record and Verify

Documentation

Manuals, Drawings, Source Code	Five copies (CD-ROM)	Allowable Formats	Verify
Parts Lists and Spares	Per SOW	Per Specifications	Verify
Traceability Certificates	Per SOW	Per Specifications	Verify
Quality Control Procedures	Per SOW	Per Specifications	Verify
Acceptance Test Plan	Per SOW	Per Specifications	Verify
Training and Materials	Per SOW	Per Specifications	Verify

Table B

Summary of Dynamometer Features

This table is presented as an overview of the major requirements of the dynamometer.
Please refer to the Statement of Work for exact requirements and details.

Inertia Range kg (lbs)	454 -6363 (1000-14000)
Roadload Selection	A, B, C coefficients, and analog grade D
Inertia Selection (No Flywheels)	Base Mechanical + Electrical Simulation
Base Roll Set Mechanical Inertia range per axle kg (lbs)	(approximate) 1636-1818 (3600-4000)
Max Vehicle Weight, per axle kg (lbs)	4545 (10000)
Test Vehicle Wheelbase Minimum Range cm (in)	218- 584 (86-230)
Speed Measurement/Control Accuracy, kph (mph)	0.016 (0.01)
Dynamometer Torque Calibration/Verification	Deadweight, Dynamic, +/- Electronic Shunts
Motors and Power Converters (IGBT)	AC Flux-Vector, motoring, regenerative
Roll Diameter, cm (in)	121.9 +/- 0.025 (48.000 +/- 0.010)
Roll Inside Gap cm (in)	91.4 (36)
Roll Outside Width Range cm (in)	254-275 (100-108)
Roll Material (corrosion protection)	Steel or Cast Iron
Roll Dynamic Balance Quality	ISO G-6.3 or better
Roll Surface Roughness Range micro-m (micro-in)	3.81-6.35 (150-250)
Bearing Quality or L10 Life	30,000 hrs minimum
Max accel rate, 2WD mode, each axle, m/sec^2 (mph/sec)	3.58 (8)*
Max accel rate, 4WD mode, each axle, m/sec^2 (mph/sec)	3.58 (8)*
Maximum Dynamometer Speed, kph (mph)	161 (100)
Roll Velocity Resolution and Accuracy, kph (mph)	Better than +/- 0.016 (+/- 0.01)
Roll Acceleration Accuracy, m/sec^2 (mph/sec)	Better than +/- 0.016 (+/- 0.01)
Roll Synchronization in 4WD mode (F-R), kph (mph)	Better than +/- 0.16 (+/- 0.1)
Total Road Load Control in 4WD Mode, greater of load value % (pounds)	+/- 1% (+/- 2)

The dynamometer shall simulate the road forces on a vehicle under all operating conditions and modes for the dynamometer setup as described in paragraphs 2.3.1 and 2.3.2.

Both 2WD and 4WD vehicles will be tested for FTP, HWFET, ECE, US06* emissions drive cycles, among others, including certain “non-standard” driving cycles. The dynamometers shall be capable of acceleration/deceleration rates of 10 mph/sec, but load control accuracy criteria only apply up to 8 mph/sec.

Appendix A

Abbreviations and Terms

AISC -	American Institute of Steel Construction
AK -	AK Protocol (version of RS-232) literally “Arbeits Kreis” working circle or group
ASCII -	American Standard Code for Information Exchange
ASHRA-	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME-	American Society of Mechanical Engineers
AWD -	All Wheel Drive
BOCA-	Building Officials' Code of America
CAA -	Clean Air Act Amendments
CFH -	Cubic Feet per Hour
CFM -	Cubic Feet per Minute
CFR -	Code of Federal Regulations
CNG -	Compressed Natural Gas
CVS -	Constant Volume Sampler
DAF -	Delimited ASCII Formats
DAQS -	Data Acquisition Systems
DCCS -	Dynamometer Control Computer System
EPA -	Environmental Protection Agency
FTP -	Federal Test Procedure
FWD -	Front Wheel Drive
GAR -	Surface Roughness Comparators (www.GARElectroforming.com)
HFEDS-	Highway Fuel Economy Driving Schedule
HFET -	Highway Fuel Economy Test
HZ -	Hertz (per second)
IEEE -	Institute of Electrical and Electronics Engineers
IFC -	Interface Computer
ISO -	International Standards Organization
LA4 -	Los Angeles Driving Cycle #4
LNS -	Laboratory Network System
LPVA -	Low Power Vehicle Adjustment
MIM -	Motor in Middle
MSDS -	Material Safety Data Sheets
NEC -	National Electrical Codes
NEMA-	National Electrical Manufacturers Association
NFPA -	National Fire Prevention Association

NFS - Network File System
NIST - National Institute of Standards and Technology
NMOG- Non-methane Organic Gas
NVFEL- National Vehicle and Fuels Emissions Laboratory
NYCC- New York City (Driving) Cycle
OBD - On-Board Diagnostics
OSHA - Occupational Safety and Health Administration
P/N - Part Number
POC - Point of Contact
PSF - Pounds per Square Foot
RFP - Request for Proposal
RL - Road Load (force)
RMD - Remote Messaging Display
RMS - Root Mean Square
RPM - Revolutions Per Minute
RWD - Rear wheel drive
SAF - Standard ASCII File
SC03 - SC03 Test or Driving Cycle (AC heat load test)
SCFH - Standard Cubic Feet per Hour
SCFM - Standard Cubic Feet per Minute
SCPI - Standard Commands for Programmable Instrumentation (Consortium)
SOW - Statement of Work
SJI - Steel Joist Institute
TCP/IP- Transmission Control Protocol/Internet Protocol,
TDAP - Test-Control, Data Acquisition and Processing
TIR - Total indicated run out
T90 - Time for an instrument to reach 90% of the final stabilized reading for a given unit step change condition
UBC - Uniform Building Codes
UDDS - Urban Dynamometer Driving Schedule
ULEV - Ultra-Low Emitting Vehicle
USB - Universal Serial Buss
US06 - US06 Test or Driving Cycle (aggressive accelerations and loadings)
VAC - Voltage w/ Alternating Current
VDC - Voltage w/ Direct Current
VDA - Video Driver's Aid
2WD - Two wheel drive, either front wheel drive or rear wheel drive
4WD - Four wheel drive - any configuration delivering power to all wheels of a four-wheeled vehicle, either continuously or intermittently

Appendix B

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Appendix C

Interface Computer (IFC)

The purpose of this appendix is to describe the interface requirements of the TDAP and DCCS with the EPA supplied IFC.

EPA shall provide the IFC. In 2002 the standard EPA IFC utilized the Windows NT 4.0 operating system. EPA-NVFEL expects in 2003 through 2005 to complete migration away from the Windows NT 4.0 operating system to Windows 2000. Use of Windows XP, Linux/Unix and later version of the Windows operating systems will be minimal. The IFC will adhere to the Appendix D - NVFEL General Interface Guidelines and NVFEL Laboratory Network System requirements in Figure 1 except as described in the following sections.

1. Configuration

   Pentium PC
   Windows NT 4.0 or 2000

1.1 Software

   Full installation of Microsoft Office 2000
   Oracle Client Tools and Net 80

1.2 Communication Protocols

   TPC/IP network protocol
   NETBUI network protocol

1.3 Network Identification

   Workgroup/Computer Name/Workgroup will be - IFC/SITE_D239 or IFC/SITE_D002 or IFC/SITE_DOO5

2.0 File Transfers Overview

Visual Basic File/Directory Commands will be used by the IFC with TDAP and DCCS. The contractor shall ensure that Visual Basic software, executing on the IFC, is able to control and supervise TDAP and DCCS file and TDAP and DCCS file-directory management utilizing disk drive, file directory and file management statements, summarized below.

The EPA IFC computer programs will utilize drive mounts or similar connections to enable Visual Basic applications to navigate directories and maintain files on the TDAP and DCCS system disk drive. Example: NFS Software has been utilized at some NVFEL test sites with Unix OS TDAPs to satisfy this requirement.

Specific Visual Basic Statements to be utilized include:

ChDir
ChDrive
RmDir
Dir
CurDir
Kill
Name
FileCopy

3.0 TDAP and DCCS/IFC During Testing Operation

Before Testing Operations - Visual Basic software running on the IFC files will control and supervise the transfer of files to established file directories on the TDAP and DCCS. Such files will include configuration information, vehicle information and testing parameters necessary to conduct TDAP and DCCS operations.

3.1 Test Time Operations - There shall be no TDAP and DCCS requirements or dependencies for interaction with IFC and any LNS components during test time operations. TDAP and DCCS shall be immune to LNS and IFC network traffic. An EPA-NVFEL network switch shall ensure isolation of the test site from non-test site network traffic.

3.2 After Testing Operations - Visual Basic software running on the IFC files will control and supervise the transfer of files from established file directories on the TDAP and DCCS to the IFC and LNS computers. Visual Basic software running on the IFC files will control and supervise the cleanup of files and established file directories on the TDAP and DCCS.

4.0 TDAP and DCCS/IFC During Calibration and Maintenance Operations

During system instrumentation calibration and maintenance procedures - there shall be no interaction with the IFC and any LNS components.

After Calibration and Maintenance Procedures - Visual Basic software running on the IFC files will control and supervise the transfer of files from established file directories on the TDAP and DCCS to the IFC and LNS computers. Visual Basic software running on the IFC files will control and supervise the cleanup of files and established file directories on the TDAP and DCCS.

5.0 File Formats

Files shall be formatted according to the General Interface Guidelines in Appendix D.

Pretest variable names, formats and definitions

TDAP and DCCS/IFC shall receive and utilize vehicle and other pre-test information from the Laboratory Network System.

Pre-test Formats
TDAP and DCCS shall utilize variable names, formats and definitions as specified.

Two formats are preferred.

Format 1:

text file
no quote “” or comma ‘,’ characters allowed
lines terminated with carriage return <CR> and line feed <LF> characters
<CR> and <LF> at the end of lines are the only non-printing characters allowed
Each line contains
Value name
Space character <SP>
Equal sign ‘=’
Space character <SP>
Value string
text string | numeric code <SP> code text | numeric | numeric <SP> units

Example:
VariableName<SP>=<SP> value string <CR><LF>

TestNumber = 20020001278
Preferred Filename = “P_” & Format(TestNumber,”0000000000”) & “.txt” = “P_20020001278.txt”

Sample File Content

TestNumber = 20020001278
MFR = 40 GENERAL MOTORS
VID = REPTRK/02
ConfigNumber = 2
ModelYear = 2001
ModelCode = 2 Truck
VehicleType = 04 Correlation
EngineType = 01 OTTO Spark
DriveCode = 1 Rear Drive Str Left
EngineCode =
ReqFuelType = 99 Other
TransCfgCode = 22 L5
TransMode =
AC = Y
FuelInj = Y
Turbo = N

EquivTestWt = 4750 lbm
CurbWt = 0 lbf
DrivAxleWt_F = 0 lbf
DrivAxleWt_E = 0 lbf
TireRimSizes = LT245/75R16
TirePSI_F = 0 psi
TirePSI_R = 50 psi
SideFan = 4 None
NmMainTnkCap = 26.0 gallon
NmAuxTnkCap = 0.0 gallon
DatabaseCode = C EPA LOD
SourceCode =
VIN =
EngineFamily =
EvapFamily =
Requester = BOCHENEK, DAVE
RequesterPh = 214-4595
TestPurpose = 11 Correlation
CertFlag = N
TestProcedur = 99 Other
TestType = Other
ShiftSched1 = FTA
ShiftSched2 = FTA
SIL =
VehicleVol = 0 ft^3
RFC =
AxleRatio = 0.00
IdleRPM = 0 rpm
IgnTiming = 0 deg
TimingRPM = 0 rpm
TargetCDT = 0.00 sec
ModelName =
NumCanisters = 0
CanWkCap = 0 gm
TotCanVol = 0.000 liter
EDynCoefSetA = 19.4 lbf
EDynCoefSetB = 0.056 lbf/mph
EDynCoefSetC = 0.03421 lbf/mph^2
EDynCoefTarA = 0.00 lbf

EDynCoefTarB = 0.000 lbf/mph
EDynCoefTarC = 0.00000 lbf/mph^2
ActDynHP = 13.3 hp
VehicleNo = 0
Transmission = auto
CanLoad = N
Evap = N
NumPreps = 0
Particulates = N
SchedComment =
VehOdoUnit = M
SH9 =
Emis_Bypass = N
SmpBag = Y
SmpDil = N
ZeroSpanByp = N
ZeroSpanCert = Y
CVSflowName = 350scfm

Format 2:

A text file bearing
<VariableName><TAB><value string><CR><LF>

Format 3: (Potential)
XML style format - negotiable
<?xml version="1.0">
<pretest>
<admin/
<variablename="TestNumber" alias="biddername" valuetext="20040123001"

numeric=”20040123001” units=””>
<variablename=”horsepowerat50” alias=”hpat50mph” valuetext=”14.5”
numeric=”+1.450000E+01” units=”lbf”>
</pretest >

5.1 Post-test variable names, formats and definitions

The format of these files shall follow the general interface guidance in Appendix D.

The specific file format is negotiable, but must be approved in advance by the EPA Project Officer.

5.2 Calibration and Maintenance variable name, formats and definitions

The format of these files shall follow the general interface guidance in Appendix D.

The specific file format is negotiable, but must be approved in advance by the EPA Project Officer.

Appendix D

General Interface Guidelines

The purpose of this appendix is to provide general interface guidance in addition to other specific guidance in this Statement of Work.

1. General Site Interface & File Formats

1.1 Network Requirements

The site computer system shall be compliant with EPA-NVFEL network requirements.

1.2 Communication Protocol

The site computer system shall be compliant with EPA-NVFEL communication protocol requirements.

1.3 File Transfer

All files created by the site computer system shall be transferable in a batch file selection and transfer mode. File transfers shall not be restricted to interactive file selection or to a single file transfer. All files shall be transferable via network interface and via removable storage media. File transfers shall not be restricted to proprietary methods or formats and shall use Commercial-Off-The-Shelf (COTS) software wherever possible.

1.4 File Format

Standard ASCII Formats (SAF) shall be used wherever available for files created by or sent to the site computer systems. Delimited ASCII Formats (DAF) shall be used for files created by or sent to the site computer system in all cases where SAF's are not available. For DAF's, the field names shall appear on the first line, data types shall appear on the second line, engineering units shall appear on the third line, and the field values shall appear on the fourth line and below. More specific DAF requirements appear in Sections 1.4.1 through 1.4.7.

1.4.1 The field names shall appear on the first line and the field types, engineering units values shall appear on lines two and below.

1.4.2 Dates shall be in "mm/dd/yyyy" formats. Time shall be in "hh:mm:ss" formats.

1.4.3 Real numbers, except for whole numbers, shall be in exponential (ñ.nnnnnnEñnn) formats.

1.4.4 Values that are not applicable for a particular field shall be filled in with a missing data code value of "-9.999E-99" for real numbers and "99" for characters.

1.4.5 Field names shall not contain embedded blanks; instead, underscores may be used to delimit.

1.4.6 Numeric data shall be right-justified and character data shall be left-justified.

1.4.7 The test report number shall follow the site computer naming convention. Export files containing data that synchronize with site computer data shall use the site computer test report number for identification.

1.5 Ease of File Editing and Installation

The site computer system shall be able to accept, validate, and use files that have been prepared or edited on external computer systems without further modifications. Installation of files shall be accomplished through a common user-friendly graphic interface rather than through cryptic installation procedures involving the typing of operating system commands or navigating through disk-drive, directory and file icons.

1.6 File Description

Information and format specifications for files that are created by or sent to the site computer system appear in Sections 1.6.1 to 1.6.15. For other files not described here, either SAF's or DAF's are required per Section 1.4 of this Appendix.

1.6.1 Test Site Configuration Files

Test site configuration files shall identify the major site components in use,

model information, software versions, and parameters that may be useful to emissions test site instrumentation, including the site computer system.

No standard format currently exists; therefore, either SAF's or DAF's are required per Section 1.4 of this Appendix.

1.6.2 Dynamometer Configuration Files

Dynamometer configuration files shall identify the major dynamometer components in use, model information, software versions, and parameters that may be useful to other emissions site instrumentation, including the site computer systems.

No standard format currently exists; therefore, either SAF's or DAF's are required per Section 1.4 of this Appendix.

1.6.3 Site Computer and Instrumentation System Configuration Files

Site and instrumentation system configuration files shall identify the major site and instrument components in use, model information, software versions, and parameters that may be useful to other emissions test site instrumentation.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.4 Site and Instrumentation Options Selection and Control Parameters Files

Files that include the option selections (see Section 4.3.1.1) and any control parameters shall contain all user selections and all modifiable site/instrumentation parameters that control site performance aspects.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.5 Test Sequence Control Schedules and Parameters Files

Test procedure control schedules shall contain driving schedule (trace) time versus analog/digital signal values (e.g., driver's pendant emulation). Test

procedure parameters shall describe the test time events (e.g., startup and shutdown methods) corresponding to the analog/digital signal values.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.6 Driving Schedule Files

Driving schedule files shall contain time versus speed values. The following driving schedules shall be useable with the site computer systems: UDDS; Hot-505 (first 505 seconds of the UDDS); HFEDS; NYCC; US06; SC03. Combinations of these driving schedules shall also be useable.

The format for driving schedule files shall be a single column of time in whole seconds and a corresponding single column of speed values expressed numerically in terms of miles per hour. A single, multiple-phase vehicle test shall require only one driving schedule file as opposed to one driving schedule file per sampled or not-sampled phase. All time and speed coordinates represent actual driving time and the first speed value shall be at t=0.0 seconds.

1.6.7 Shift Schedule Files

Shift schedule files shall contain either time versus gear values or speed versus gear values. Gear values may be represented by the gear number (i.e. 1 for first gear, 2 for second gear, etc.) or by a character (P for park, R for reverse, N for neutral, D for drive, etc.).

The format for shift schedules shall match the EPA shift schedule file format documented in the EPA Application for Certification Format Document. This format is SAF and includes schedule identification information, shift patterns, comments, and shifting point instructions corresponding to specific driving schedules. Shift points include driving schedule time (to the nearest tenth of a second), target shift speed (to the nearest tenth of a mph), and the shift action code.

1.6.8 Vehicle and Test Parameter Files

Vehicle and test parameter files shall include information necessary for vehicle

identification and operation under test conditions. Vehicle identification shall include key database fields used to tag data files. Test parameter values may include inertia weight, dynamometer loading coefficients, target coast-down time, equivalent test weight, and dynamometer roll geometry (number of rolls per axle, number of axles to drive, and roll diameters).

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.9 Test Definition Files

Test description files shall include information necessary to select test descriptions, test sequence control and parameter, drive schedules, shift schedule, vehicle and test parameter files to be used in a single instance of a vehicle test.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.10 Mode Definition Files

Mode definition files shall describe the modes of a test description and shall identify the type, beginning trace time, duration in seconds, and ending trace time of each mode.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.11 Acquired Hertz Data Files

Acquired Hertz data files contain recorded analog or digital values gathered at specific frequencies during tests. Data recorded at different frequencies will require separate files.

The format for acquired Hertz data files shall be DAF with one data field per column and corresponding field names in the first row.

1.6.12 Acquired Non-Hertz Data Files

Acquired non-Hertz data files contain data not recorded at steady frequencies during tests.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.13 Input File Validation Reports

The site computer shall be able to accept, validate, and use files that have been prepared by external systems. If the file is not usable, the site computer shall generate a file validation report clearly identifying conflicts, as well as all formatting and content errors in the file.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.14 Data Analysis Report Files

Test-time and post-test data analysis reports shall contain any analyses performed by the site computer on data collected during a test.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

1.6.15 Event Log Files

All significant events shall be logged and time-stamped with clock time and trace time. Significant events include (but are not limited to) system power-up, reset, initiation and termination of setup and testing events, ready to test conditions, changes in ignition key positions, end of crank, engine start-up, engine shut-down, drive trace beginning and ending, control events (see Section 4.4.6.5), operator interventions, beginning and ending of trace idles, beginning and ending of soak periods, and the beginning and ending of emergency shutdowns and other safety events.

No standard format currently exists; therefore, either SAF's of DAF's are required per Section 1.4 of this Appendix.

Appendix E

The document shown below originally appeared in the Statement of Work for the emissions measurement system for D329, where the 4WD dynamometer is to be installed. This document appeared in that SOW to present additional requirements for the interface of the measurement system control computer, referred to as TDAP with the dynamometer computer control system. The dynamometer contractor shall also meet all the following requirements applicable for that interface. The measurement system contractor and dynamometer contractor may also coordinate alternate solutions to this interface that satisfy the requirements, with EPA approval, provided there is no additional cost to EPA or delay in installation. All references in the following document are to other portions of the measurement system SOW.

Dynamometer Data and Control Interface

The dynamometer will be provided under a separate contract, but integration with TDAP shall be included as part of the effort described in this Statement of Work.

1. Physical Characteristics

1.1 The Dynamometer computer will be the contractor's choice and will meet the interface requirements of the Interface Computer as described in Appendix C.

1.2 Dynamometer A/D I/O hardware will be the contractor's choice.
Digital signals will be either 24 VDC or 5VDC
Analog signals will be +/- 10 VDC
Optical Encoder Signal Availability:

1.3 The TDAP shall measure distance by counting dynamometer roll revolutions. The Dynamometer shall split each optical encoder pulse signal to two connectors that will make pulse signals available for (1) independent speed and distance determination by the TDAP or a customer data acquisition system, and (2) the dynamometer control system to perform its work. The pulse signals shall be a square wave 0-5 VDC. The TDAP or data acquisition systems using the connector shall be sufficiently isolated and conditioned so that connecting,

using, and disconnecting from the pulse signal connector will not affect active use by the dynamometer control system.

1.4 The Dynamometer shall split the each load cell signal to two connectors that will make voltage signal available for (1) independent force determination by the TDAP or a customer data acquisition system, and (2) the dynamometer control system to perform its work. The load cell signals for the TDAP or customer data acquisition system will be ±10 VDC. The TDAP or data acquisition systems using connector shall be sufficiently isolated and conditioned so that connecting, using, and disconnecting from the voltage signal connector will not affect active use by the dynamometer control system.

2. Dynamometer-TDAP Interaction and Interface

The TDAP contractor shall negotiate and work with the Dynamometer contractor to ensure that requirements of this section are satisfied using Ethernet file exchanges, AK/Ethernet command protocol, SCPI/Ethernet command protocol, or digital/analog signaling as appropriate. Alternatives to the digital/analog signaling methods described below must be approved by the EPA Project Officer.

2.1 At time of test the TDAP shall execute pre-test setup process to deliver pretest information to the dynamometer computer. Included with the pre-test information will be:

- Vehicle ID
- Vehicle Track Road Load ABC coefficients (pound-force, mph)
- Dyno Simulation Road Load ABC Coefficients (pound-force, mph)
- Equivalent Test Weight (pounds)
- Test number
- Test Date
- Configuration (FWD/RWD/AWD)
- Augmented braking (On/Off)
- Dynamic Load Adjustment (On/Off)
- Wheelbase (inches)

2.2 Immediately upon completion of a vehicle test TDAP shall execute post-test process to retrieve information to the dynamometer computer. Included with the post-test information will be:

- Vehicle ID
- Vehicle Track Road Load ABC coefficients (pound-force, mph)
- Dyno Simulation Road Load ABC Coefficients (pound-force, mph)
- Equivalent Test Weight (pounds)
- Test number
- Test Date
- Configuration (FWD/RWD/AWD)
- Augmented braking (On/Off)
- Dynamic Load Adjustment (On/Off)
- Wheelbase (inches)
- Parasitic loss coefficients
- HP@50
- Simulated Inertia (pounds)
- Total energy from vehicle per phase (KW-Hrs, Hp-Seconds, Foot Pounds)
- Total energy to vehicle per phase (KW-Hrs, Hp-Seconds, Foot Pounds)
- Positive energy simulation error (RMS%) per phase
- Negative energy simulation error (RMS%) per phase
- Total simulation error (RMS%) per phase

2.3 The TDAP contractor shall negotiate and work with the Dynamometer contractor to ensure that the TDAP and Dynamometer systems mutually achieve the appropriate and safe states of operation prior to allowing various modes of operation to begin. At the start of the test TDAP shall issue a test / reset command (bit=high) to the dynamometer. The dynamometer computer will then set a test-ready status indicator with 24 VDC or 5VDC digital signals. The TDAP, upon initiation of a test and during the test, monitors for the presence of the "ready for test" digital signal from the dynamometer. The TDAP may need to wait for the "ready for test" digital signal to appear. Once the "ready for test" digital signal is recognized, the TDAP may then proceed with test execution once it has determined that all other instruments and systems necessary for the test are ready.

2.4 The TDAP shall monitor and record all key test and dynamometer events. This shall be done, in part, with 24 VDC and 5VDC digital signals. Key test-time events indicated via digital signal to the TDAP by the dynamometer immediately before and during procedures include:

- Dyno in run mode - real time digital signal goes high only when the dynamometer is in run mode.
- Low power vehicle adjustment on - real time digital signal goes high only when power reduction turns on. TDAP shall continuously record this status as part of the test data.
- Grade simulation active times - real time digital signal goes high only when road grade simulations are in effect. TDAP shall continuously record this status as part of the test data.
- Partitioning of procedures - At the completion of each phase the driver's aid will issue a phase reset command. At the end of the test sequence TDAP will change the test / reset command (bit=low)]
- Other signals may include abort test.
- Dynamometer shall issue critical system status and critical alarm signals to the TDAP. The TDAP will relay the appropriate text messages to the driver via the driver's aid per the communication protocol outlined in Appendix B.

End of Appendix E

Appendix F

Schedule of Deliverables

Dates shown are nominal completion deadlines relative to the contract award date or exercise option date. Where dates are not shown, the contractor shall propose appropriate dates at the Project Kickoff Meeting. All days are calendar days. All Technical Interchange Meetings (TIMs) are to be held at EPA-NVFEL. Video conferencing will be an acceptable alternative for some meetings. The contractor or EPA, as needed, may schedule TIMs. Incentives/penalties are provided for early/late completion of certain critical phases.

D329 4WD Dynamometer

Project Kickoff Meeting and Site Survey at EPA-NVFEL (25 days)
Submission of Project Management Plan (30 days)
Project Management Plan TIM (35 days)

- Project Programming or Methodology
- Project Management Schedule for key events and milestones (e.g., MS Project)
- Schedule/Triggers for Technical exchange meetings and approvals
- Quality Assurance
- Schedule for Status Reports
- Open Item Tracking

Weekly Status Report/Open Item Tracking Submission (Starting after project kickoff)
Preliminary Design Submission (40 days)

- Test cell layout, equipment design and layout, functional specifications

Preliminary Design Review TIM Meeting (45 days)
EPA Preliminary Design Approval
Submission of Proposed Acceptance Plan (90 days)
Acceptance Plan Review TIM
Submission of Final Acceptance Plan (105 days)
EPA Acceptance Plan Approval (115 days)
Submission of Standard-Function Report Layouts for Approval
Submission of Pretest Data Entry and Test Set-Up Screens for Approval
Submission of Calculation Verifications (160 days)

Submission of Preliminary Equipment Qualification Results to EPA (200 days)
Submission of Contractor-Site Acceptance Dates to EPA
Submission of Calibration Reports and Measurement Traceability Documentation
Contractor-Site Acceptance Testing Completed (235 days)
Equipment Delivery Date Confirmation to EPA (20 days in advance of shipment)
Submission of Summary Report of Contractor-Site Acceptance Results (240 days)
Submission of Installation Material Data Safety Information to EPA for approval
EPA Authorization to Ship (10 days after receipt or Acceptance Report)
EPA-Provided Contractor Safety Training
Equipment Delivery to EPA
Equipment Installation (295 days)
Equipment Commissioning (320 days)
Preliminary Acceptance Testing (Basic Functionality) (340 days)
Final Acceptance Testing (375 days)
Training and Submission of all Documentation (390 days)
Final EPA Approval

ATTACHMENT 3

CONTRACT LINE ITEM NUMBERS

CLINS

BASE REQUIREMENT

Line Item	Description	Qty	Units	Unit Price	Total Price
0001	Four Wheel Drive Medium Duty Dynamometer with acceptance testing and warranty in accordance with attached SOW	1	Lot	$	$

OPTIONS: MAINTENANCE

0002 Option Period 1, One Year After Acceptance through Second Year after Acceptance

Line Item	Description	Qty	Units	Unit Price	Total Price
0002A	Remedial Maintenance- Repair in accordance with the attached SOW (contractor will be reimbursed only for those hours performed)		HRS	$	$
0002B	Preventative Maintenance- Repair schedule in accordance with Standard Commercial Practice, Minimum 1 per Year	1	LOT	$	$
0002C	Replacement Parts and Equipment (contractor will be reimbursed only for those parts and equipment replaced)	1	LOT	Not to Exceed	$

0003 Option Period 2,Two Years After Acceptance through Third Year after Acceptance

Line Item	Description	Qty	Units	Unit Price	Total Price

0003A	Remedial Maintenance- Repair in accordance with the attached SOW (contractor will be reimbursed only for those hours performed)		HRS	$	$
0003B	Preventative Maintenance- Repair schedule in accordance with Standard Commercial Practice, Minimum 1 per Year	1	LOT	$	$
0003C	Replacement Parts and Equipment (contractor will be reimbursed only for those parts and equipment replaced)	1	LOT	Not to Exceed	$

0004 Option Period 3, Three Years After Acceptance through Fourth Year after Acceptance

Line Item	Description	Qty	Units	Unit Price	Total Price
0004A	Remedial Maintenance- Repair in accordance with the attached SOW (contractor will be reimbursed only for those hours performed)		HRS	$	$
0004B	Preventative Maintenance- Repair schedule in accordance with Standard Commercial Practice, Minimum 1 per Year	1	LOT	$	$
0004C	Replacement Parts and Equipment (contractor will be reimbursed only for those parts and equipment replaced)	1	LOT	Not to Exceed	$

ATTACHMENT 4

TECHNICAL EVALUATION FACTORS

Technical Evaluation Criteria

Medium-Duty, Four Wheel Drive Dynamometer for EPA-NVFEL

Evaluation - Commercial Items

A. The Government will award a contract resulting from this solicitation to the responsible offeror whose proposal conforming to the solicitation will be most advantageous to the Government, price and other factors considered.

The following requirements shall be evaluated on a Best Value basis. Offerors shall provide information to demonstrate / substantiate that the proposal meets the minimum requirements.

Offerors shall:

1. Demonstrate that the proposal meets all the minimum requirements of the Government and fulfills EPA's needs as set forth and described in the Statement of Work and Proposal Instructions.

2. Describe how the proposal meets or exceeds requirements in the following critical aspects:

   (a) Basic dynamometer performance, including response time, roll synchronisation, load accuracy and frictional stability, capacity and capability.

   (b) Configuration of the vehicle restraint system for safety, simulation accuracy and ease of use.

   1.3 Integration of Safety and Quality Control provisions to assure system integrity, and high standards of performance on a per test (or other specific operation) basis, including utilization of trend analysis and statistical process control, to alert the user to abnormal conditions.

   1.4 Implementation of a dynamometer system meets the requirements for accurate and precise measurements.

   1.5 Physical integration of the dynamometer with all aspects of the existing and proposed facility, including configuration of the deck system, fixed and moving rolls, ventilation and installation details.

1.6 Description of auxiliary equipment, methods, or techniques that are used to improve efficiency, simplify tasks and assure test validity and integrity.

1.7 Implementation and integration of all the test data collection, processing, information management and file transfer, and reporting methods to assure compliance with regulation and accepted standard practices and to facilitate user friendly information management tools.

3. Provide information on previous work that demonstrates experience with fabrication and installation of four wheel drive dynamometers similar to the one described in the Statement of Work. Such information may include drawings, photographs, technical data or papers, catalogs, project management information, etc.

4. Submit a list of contracts and subcontracts completed which are similar in nature to this requirement. The contracts and subcontracts listed may include those entered into with Federal, State and Local governments, and commercial businesses, which are of similar scope, magnitude, relevance, and complexity to the requirement which is described in the RFP. Provide a point of contact for each cited contract and/or subcontract with the name of the client, telephone number, and period of performance.

5. Demonstration of how the requirements identified in the Scope of Work, such as Section 1.8 (Project Management) will be satisfied to effectively deliver and install an dynamometer system. These include, but are not limited to: Project planning, scheduling, and issue tracking, and an Acceptance Test Plan that addresses Working On-Site at NVFEL, Installation, Commissioning, Acceptance Testing, Warranty, Spare Parts, Documentation, and User Training.

2. Responses to the above factors shall be evaluated on the following scale:

Unacceptable: Does not meet all requirements of the SOW.

Acceptable: Meets all minimum requirements of the SOW.

Superior: Exceeds the Government's minimum requirements.

C. After the responses have been evaluated against the factors above, a contract will be awarded to the offeror that represents the **Best Value** to the government. Price may not be the determining

factor. The Government reserves the right to award on initial proposals or may choose to conduct negotiations if it is in the Government's best interest.

D. A written notice of award or acceptance of an offer, mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer, shall result in a binding contract without further action by either party.

ATTACHMENT 5

TECHNICAL PROPOSAL INSTRUCTIONS

Technical Proposal Instructions

Medium-Duty, Four Wheel Drive Dynamometer for EPA-NVFEL

General Requirements

The contractor shall submit an original and three (3) copies of its technical proposal.

The contractor's proposal shall include a list of system electrical requirements, including specific requirements for voltage, amperage, phase and requirements for clean power. The proposal shall include a list of system electrical requirements, including kVA and kW required, amperage per phase, and number of phases required for each type of power. Requirements for equipment loads exceeding 3kW or loads with high inrush current shall be separately identified in the proposal.

Electrical loads greater than 1kW, and with a power factor less that 0.8, shall be identified in the proposal. Any unusual requirements for electrical power or equipment grounding shall be identified.

EPA is investigating additional features for future enhancements that may be desirable and add flexibility. Therefore, for the purpose of market research, offerors may provide information on the following features EPA finds desirable.

(1) Any additional features that would allow for the future cost-effective addition of a third chassis roll as described in Section 1.3.1. and

(2) Any additional features that would allow for partial or full bi-directional functionality of dynamometer

If these features are already available in the base system, they will be considered as part of the technical evaluation of the base systems.

Please provide this information in a separate section of your technical proposal.

Specific Requirements in Response to the Technical Evaluation Criteria

(1) The contractor's proposal shall address ALL minimum requirements set forth in the Statement of Work, including any proposed solutions would enhance the performance of the delivered dynamometer system beyond the minimum requirements. **Proposals shall be structured in a manner that clearly and specifically addresses each individual requirement**, in the same order and general format in which they are presented in the Statement of Work. Generic statements indicating that the system meets a SOW requirement are not considered acceptable. Specific information demonstrating that the system meets each requirement is required.

(2) The following instructions are intended to further define certain information critical to proposal evaluation.

(a) The contractor shall provide its detailed dynamometer performance, capacity and capability specifications. These specifications shall also include pertinent details of the measurement methods used to generate the specification, such as the type of test utilized, any averaging employed, and statistical details, such as level of confidence.

(b) The contractor shall describe and illustrate the vehicle restraint system, other auxiliary equipment such as beams and fixtures used in load cell calibration, and the optional tire guards. Describe any lifting requirements associated with installing or removing these devices in normal operation.

(c) The contractor shall provide a summary of its safety, health and environmental considerations in its proposal.

The contractor shall provide a Quality Assurance Plan showing how they will assure compliance with contract requirements and how the products delivered will support a system of on-going quality assurance. The contractor shall describe its general approach to run time quality control in their proposals. The specific equipment acceptance requirements contained in Section 5 of this Scope of Work shall be included in the Quality Assurance Plan.

(d) In its proposal, the contractor shall explain, and demonstrate with data, the accuracy and precision of the measurement systems associated with the dynamometer. Any averaging/filtering algorithms used in association with the measurement function shall also be described and characterized. This information shall include a description of the equipment and methods used to determine acceleration. This description shall include actual data to document measurement performance. Any proprietary algorithms shall be held confidential under a non-disclosure agreement if its description is required for compliance with this requirement.

(e) The contractor's proposal shall include a description of other facility related requirements such as temperature, ventilation, etc. This description shall also include data related to any significant heat rejection from the dynamometer and related components

The contractor shall describe and illustrate its proposed test site configurations. Describe and illustrate displays, controls, warning devices and other interface devices, including proposed locations. Describe and illustrate any special mounting provisions or any associated requirements not provided by the contractor. Describe any other significant, proposed physical modifications to the test site or facility.

(f) In its proposal, the contractor shall describe significant ways that the delivered dynamometer will support operational efficiency, including reliability and maintainability. This shall include any significant ergonomic considerations with respect to physical design and layout and clarity and ease of use of operator interface with automated systems. The contractor shall specify recommended maintenance and calibration intervals.

The contractor shall describe any additional devices, displays, or controls that enhance the setup, operation, quality, safety, and efficiency of the system and can be integrated with the delivered system. A bar code reader, driver intercom to the control room, or portable wireless data entry pad are examples that may have enhance the system.

(g) The contractor shall provide a complete description of computer hardware and operating software in its proposal. The contractors shall detail its proposed computer system interface design and protocols. Describe methods for implementation and integration of all the test data collection, processing, information management and file transfer, and reporting methods.

(3) In its proposal, the contractor shall provide evidence that its dynamometer systems have general acceptance in the automotive emissions testing industry by listing different certification test laboratories using similar dynamometers systems for emissions and fuel economy measurement. This listing shall include a brief description of each dynamometer and a contact name for each laboratory.

(4) The contract shall submit a list of contracts and subcontracts completed which are similar in nature to this requirement. The contracts and subcontracts listed may include those entered into with Federal, State and Local governments, and commercial businesses, which are of similar scope, magnitude, relevance, and complexity to the requirement which is described in the RFP. Provide a point of contact for each cited contract and/or subcontract with the name of the client, telephone number, and period of performance.

(5) The proposal shall include a comprehensive explanation of the management of the project, including a Gantt chart showing major milestones, personnel support plan, plan for monitoring and managing all key activities including installation. The offeror shall specify recommended maintenance and calibration intervals in its proposal.

ATTACHMENT 6

QUALITY ASSURANCE PROVISIONS

Quality Assurance Plan

EPA desires a quicker response and is negatively impacted by a longer response. As such, earlier delivery of an acceptable product is to be incentivized. In order to ensure that the quality of the data is not sacrificed, there is no incentive for delivery earlier than the dates specified below. The following chart details the monetary plan for earlier delivery.

Deliverable	Receipt of Deliverable	Incentive/Disincentive	Surveillance Method
Completion of commissioning of the 4 Wheel Drive Medium Duty Dynamometer	Calendar Day 320	For each calendar day prior to the 320 calendar day requirement that the equipment commissioning is completed, the contractor shall receive $1,000. Maximum incentive shall not exceed $35,000. Award of this incentive is also contingent upon successful, on-time completion of all final acceptance testing requirements.	The contractor will be notified the day of award. The day following contract award will be considered Day 1.
Completion of commissioning of the 4 Wheel Drive Medium Duty Dynamometer	Calendar Day 320	For each calendar day after the 320 calendar day requirement that the equipment commissioning is completed, the contract price shall be reduced by $1,000. Maximum disincentive shall not exceed $70,000.	The contractor will be notified the day of award. The day following contract award will be considered Day 1.
Final Acceptance Testing	55 Days After Commissioning	For each calendar day after 55 days after commissioning that the final acceptance testing is not completed, the contract price shall be reduced by $1,000. Maximum incentive shall not exceed $70,000.	The contractor will be notified the day of award. The day following contract award will be considered Day 1.

ATTACHMENT 7

FIGURES